FORESTRY ABSTRACTS

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CONTENTS

PAGE NO.

RECENT WORK ON THE PRUNING OF FOREST TREES WITH PARTICULAR REFERENCE TO *PINUS* SPP. 97

ABSTRACT SECTION:

- General Forestry 108
- Fundamental Natural Laws of the Forest 113
- Silviculture 128
- Forest Utilization. Forest Technology 140
- Protection 156
- Mensuration. Increment. Yield 161
- Management. Working Plans. Surveys 162
- Forest Policy 164

BOOKS 167

NOTES FROM ANNUAL REPORTS 169

LIST OF ADDITIONAL ABBREVIATIONS 174

FORESTRY ABSTRACTS

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RECENT WORK ON THE PRUNING OF FOREST TREES WITH PARTICULAR REFERENCE TO *PINUS* SPP.

IT has been pointed out recently by Craib [8] that there is very little statistical evidence in support of or in opposition to the practice of pruning for the production of clear lumber. However, there is a considerable amount of other evidence recorded both from observation and experiment by a number of workers in different countries. Two recent trends in the forest policies of certain countries are largely responsible for an increased interest in the pruning of forest trees: (1) The extensive planting of exotic conifers, often at a wide spacing, in countries such as Australia, New Zealand and South Africa. (2) The use of otherwise unemployed labour on relatively intensive forest improvement work under Government authority, particularly in the United States. These developments have naturally led to investigations of tools and methods in order to increase the efficiency and value of pruning. The purpose of this article is to indicate the trend of recent work on this subject and thus to suggest possible lines for future investigation. The extent of the literature has made it necessary to limit this review to work that has been undertaken with species of Pine.

OBJECTS OF PRUNING.

Hawley and Clapp [18] remark that the only justification for pruning on a commercial scale is the resulting increase in timber value, that is of course if the clear wood thus produced sells at a higher price than the knotty lumber from unpruned trees. In regions where wide spacing of plants is practised and canopy does not close rapidly, artificial pruning is essential for the production of clear wood and is particularly applicable to fast-growing species [11]. The pruning of forest trees may also be undertaken to meet special local conditions as in the removal of the lower dead branches from all trees as a fire-protection measure or to improve working conditions in the stand, or the production of clear wood may be secondary to such immediate objects as the release of advance growth, improvement of tree form, correcting malformations in young trees, minimizing snow damage, and restoration of balance between root and leaf activity following a period of adverse conditions.

FACTORS THAT AFFECT PRUNING.

There are a number of factors each of which contributes more or less to the problem of pruning any particular stand of trees and which should be carefully considered before large-scale pruning operations are started.

(a) Persistence of living and dead branches.

It is most important to have some knowledge of the inherent ability of a species to prune naturally before beginning an intensive artificial pruning operation [20]. One aspect of this problem is the persistence of living branches which may vary with tolerance to shade or density of stocking. According to Paul [33] branches on the lower 20 ft. of the stem remain alive on Red Pine (*Pinus resinosa*) and Northern White Pine (*P. strobus*) for an average of 15 years, on Slash Pine (*P. caribaea*) for 9 years, on Shortleaf Pine (*P. echinata*) for 8 years, and on Longleaf (*P. palustris*) and Loblolly Pine (*P. taeda*) for 7 years. A second aspect of the problem is the tendency for branches to remain attached to the bole of the tree for a considerable time after they are dead. While close spacing may cause early death of the lower branches and result in relatively smaller knots [41], this does not necessarily solve the problem of knotty wood, as often small dead branches persist much longer than large ones as the former tend to dry out to a moisture content below that which will support the growth of wood-destroying fungi—and the tendency for dead branches to remain on the stem is clearly influenced by resistance to decay. Red and particularly White Pine are noted for persistence of dead branches. Paul [33] found that the average period of time that overgrown dead branches persisted on the lower 20 feet of these species was 24 and 27 years respectively, though maximum periods were much longer. Mollenhauer [30] suggests that dead limbs persist on White Pine for 30 to 50 years.

Western White Pine (*P. monticola*) shows a similar trait. In a study of two trees of this species Rapraeger [35] found that branches on the first 20 feet of the bole lived for an average of 20 years but that it required 72 and 93 years after the branches had died until clear wood was produced. The tendency for White Pine, in densely stocked, pure plantations, to retain dead branches, makes artificial pruning a necessity if clear lumber is to be produced from second-growth stands growing on a relatively short rotation.

(*b*) *Branch type and size.*

The branches of conifers are usually developed each year from the lateral buds at the base of the terminal bud with the result that there is one whorl of branches or node for each year's growth. Pines, however, may be divided into uninodal and multinodal types [22]. Species of the first group, of which White Pine is an example, have a regular annual resting period and normally produce one whorl of lateral branches per season. In species of the second group, of which *P. radiata* is probably the best example, the leading shoot may continue growth for two or three years before developing a terminal resting bud, although branches of the second and higher orders form resting buds each season. During its main height growth this species puts on a number of whorls of lateral branches annually, the number varying with age of tree, rainfall, and the strain of the species. The strains of *P. radiata* which produce many whorls and have short internodes may contain more branches than other types but they are relatively easy to prune as the branches are small and at a wide angle to the bole of the tree. It has been found that for this species the branch angle has a definite tendency to be more acute for the larger branches particularly when there are a number of large branches in a single whorl, and that green pruning has the effect both of increasing the size of the branches immediately above the pruned zone and of decreasing to a significant extent the angle which these branches make with the bole of the tree. Large branches at an acute angle to the tree are difficult and costly to prune as they are hard to get at, their weight does not assist the pruner and saws designed for cross-cutting are at a disadvantage as the action is mainly one of ripping. It is noted that Longleaf and Loblolly Pine are relatively easy to prune as the branches are few and accessible, and the bark does not tend to tear as the branch falls away from the tree [5].

The size of branches may increase from the bottom towards the top of the tree. This was found to be the case for the first 20 feet of stem of a number of North American species of Pine, particularly the relatively less tolerant southern Pines [33]. Rapraeger [35] found that on Western White Pine the branch size tends to increase higher up the tree where the branches are longer lived.

The branch type is an important factor in the economics of Scots Pine (*P. sylvestris*) pruning in Sweden. Romell [38] quotes an experienced forest manager as stating that Pine of a certain northern district is in demand for its high quality although the timber is full of knots under ½ in. in diameter. Artificial pruning would hardly increase the value of such material, in spite of the fact that in northern Sweden, according to Romell, the interval between the death of a branch and the healing of the wound after its fall, averages over 100 years. In the coarse-branched type, on the other hand, even relatively late pruning may still be worth while. Thus Enander [14] reports satisfactory financial results from the live pruning, some 60 to 70 years before felling, of about 40- to 50-year old, coarse-branched Pine in the Crown Park of Böda.

(*c*) *Rate of growth and speed of occlusion.*

The growth rate of the trees immediately after pruning is a most important factor in the success of the operation as on it depends the speed of occlusion of the pruning scars and the production of clear wood. In general the rate of growth is determined by the inherent capacity of the tree and the effect of the environment or site. Obviously it will be uneconomical to prune trees that cannot put on rapid growth under any circumstances. But where potentially fast-growing trees are suppressed through overcrowding, pruning should be accompanied by thinnings sufficient to give the trees ample opportunity for a high growth rate throughout the rotation. Pruning schedules developed in South Africa require that a minimum radius of 4 in. be imposed on the knotty core of the pruned tree before felling [8]. A case is reported of *P. ponderosa* pruned at 17 years where all the room necessary for maximum growth was given and complete healing took place within 3 years and 3 in. of clear wood had grown over the stub at the end of 8 years [37]. Paul [33] found in one case that the average time required for healing over the first pruning up to 6 ft. was only 3 years for White Pine and 5 years for Red Pine, the branches being alive in both cases. It may be noted that heavy

thinning will result in increased growth of the branches left on the stem as well as increasing the stem increment [8, 22], and that this increase in branch size has an adverse effect on stem form above the pruned zone [22].

The relation between degree of live pruning and the rate of growth of the pruned tree has received considerable attention in the literature. It is observed by Cline and Fletcher [6] that the live pruning of White Pine will have no serious or lasting effect on height growth if confined to the lower half of the total height of the tree, while Hawley [20] has shown that the height growth of a young White Pine plantation was decreased by one-third following the removal of more than 50 per cent. of the living crown. Hicock [21] concluded that up to one-third of the living crown height could be removed in young Red Pine plantations before the crowns had closed without causing much curtailment of height growth. Diameter measurements over a period of 30 years of 8 pruned and 8 unpruned Ponderosa Pine, averaging 17·6 in. d.b.h., suggest that the removal of approximately one-third of the living crown reduces growth throughout the whole stem over a long period of time [42]. On the other hand Roche and Hocking [37] report an experiment in an 8-year-old stand of this species spaced at 8 × 8 ft. in which pruning was carried out at varying intensities including the removal of all laterals. After six growing seasons it was found that in all cases reduction in diameter and height growth had been small and was soon overcome, and that no epicormic branches were produced. Preliminary results from an experiment to determine the effect of various intensities of live pruning on 4-year *P. patula* in South Africa indicate that the removal of branches up to half the total living crown length results in only a slight and temporary reduction in height and diameter increment although the adverse effect is marked if a higher proportion of the living crown is removed [8]. Under favourable conditions of climate and soil fairly severe green pruning of 4- or 5-year-old *P. radiata* has little effect on the height or basal area increment [17, 22]. Jacobs points out, however, that the pruning of such young trees removes branches largely from below the point of diameter measurement so that the effect is not appreciable, and secondly that fascicle buds in young trees are able to develop much more rapidly than in older trees and the crown is quickly built up with epicormic branches. Investigations on *P. radiata* [22] showed that the effect of green pruning on diameter growth was more marked when pruning was confined to selected trees surrounded by unpruned trees than when the whole stand was pruned and all trees were almost equally efficient in utilizing the site. The length of time during which increment is reduced as a result of green pruning may be considerably lengthened if selected pruned trees are surrounded by large unpruned trees that are not fit for treatment.

(*d*) *Defects.*

Another factor that requires consideration is whether injury from insects or plant diseases is likely to follow pruning. It has been shown that defects resulting after careful pruning of live White Pine limbs 1 in. in diameter or less are usually confined to localized discoloration of the wood or a thin layer of hardened pitch at the surface of the pruning cut and cannot constitute an important objection to the operation, whereas the more serious defect of a pitch or bark pocket may follow the pruning of live branches larger than 1 in. in diameter [6, 18]. The wounding of the bole of the tree or the breaking of a branch stem inside the bole as a result of axe pruning may produce large and serious defects. The danger of infection by the fungi *Trametes pini* and *Stereum sanguinolentum* is slight when only small branches are removed but is increased with the pruning of large, green branches having a dry heartwood [6, 40]. An examination of 646 pruned knots in Red and White Pine, resulting from both dead and live pruning, gave no evidence that pruning caused the entrance of decay in the branch stubs or of the spread of decay from infected dead branches into the main stem. Other pruning defects such as pitch and bark pockets were soon covered over unless the pruning had been done carelessly [33]. An analysis of pruned coniferous trees in Great Britain showed that the stain or rot localized at the knot had in no case spread into the wood of the bole [13]. Roche and Hocking [37] in studying the effect of careful green pruning on various exotic Pines in New Zealand could find no indication of the entrance of heart rot or the spread of stain by fungi as a result of pruning, except for a localized spread of decay following the pruning of dead branches from *P. austriaca*. Bark pockets may be prevented by green pruning or by pruning before bark inclusion has started [37] and this is a further justification for the early treatment of such species as *P. radiata* [22]. The presence of the two insects, the pitch mass borer (*Parharmonia pini*) and

the pitch midge (*Retinodiplosis* sp.), is sometimes associated with pruning wounds, but it is pointed out by Curtis [10] that they probably do more good than harm, particularly in pitching over the stubs of dead branches.

(*e*) *Economics.*

Whether pruning is justified or not is primarily an economic problem and depends on whether the improvement in the quality of the timber causes an increase in the sale value that exceeds the cost of the operation compounded at a reasonable rate of interest. Sound management demands that pruning be confined to operations likely to prove profitable. In general, present market conditions favour clear stems as compared with knotty wood. The question is whether the difference justifies the expense and this will have to be answered for each region separately, the main items to take into consideration being cost of the operation, length of rotation, and the potential market for clear lumber. While the actual cost of pruning has been investigated by a number of workers in different countries [5, 6, 16, 18, 23, 25, 29, 34, 43, 44], the whole question of the economics of pruning has not received the attention that it deserves. The economic question is complicated and it takes a long time to show results, and when the work is done the data generally apply only to a particular district. Certainly more work is needed on this part of the problem so that facts may be determined on which to base general principles.

With regard to the cost of pruning, the most important factor is the size of the branch to be cut and this is controlled largely by density of stocking [6]. Roche and Hocking [37] report that the average diameter of laterals of *P. ponderosa* in a 13-year stand at 8 × 8 ft. spacing was 1·32 in., while for the same species at 23 years and 4 × 4 ft. spacing it was only 0·67 in. Selection and accessibility of the trees to be pruned and the efficiency of the workmen are other factors influencing cost. Taking all contributing factors into consideration, the time-cost for pruning White Pine was found to vary from 50 linear feet of bole per man-hour in badly weeviled plantations to 200 linear feet in densely stocked natural stands [6]. It is suggested that a profitable pruning operation can be undertaken in weeviled White Pine stands by treating some 275 selected, straight-boled trees per acre to a height of 14 ft. at a rate of about 150 linear feet per man-hour [7]. Meyer [29] reports the pruning of Red and White Pine in natural mixedwood stands in one operation to an average height of 14·7 ft. at the rate of 176 bole feet per man-hour, while Hawley and Clapp [18] found that speeds of 100 to 200 linear feet of bole per man-hour could be obtained in White Pine only when pruning a relatively short total length (as 12 to 16 ft.) in one operation, on well formed trees in a natural stand, removing mostly dead limbs. It was found that Red Pine could be pruned in 65 to 75 per cent. of the time required for White Pine because the former species is commonly less pitchy and has fewer and smaller branches.

Apart from branch size, two other factors that directly affect labour requirements for pruning are position and length of tree section pruned and the diameter of the stem at breast height [5]. The effect of these variables on the basic, effective working time used in pruning open-grown Longleaf Pine has been found to vary between ·005 man–hours for the 0–7 ft. section of a 3-in. tree, ·028 man-hours for the 0–17 ft. section of a 3-in. tree, ·006 man-hours for the 0–7 section of an 8-in. tree, and ·073 man-hours for the 0–17 ft. section of an 8-in. tree, using in each case the fastest men and implements available. Figures are also given for average conditions and it is shown that approximate elapsed working time may be determined by the use of rough converting factors.

The number of operations in which the final pruning is to be accomplished may have some effect on the total cost of pruning though there is little information available on this point. In a test on *P. radiata* it was found that pruning in two operations was quicker than one and there are indications that the efficiency of a heavy pruning operation is improved by increasing the number of rests and shortening the periods of actual cutting [22]. Experiments in Red Pine stands of two age classes (17 and 23 years) indicate a saving in time by pruning in at least two operations, the first being made when the stem and the branches on the lower portion of the stem are relatively small [32]. While the cutting of small branches from small to medium-sized trees in two or more operations is generally considered cheaper than removing larger branches from medium-sized trees in one operation [20], Guillebaud [16] reports that in pruning Scots Pine, young plantations may be more expensive than older stands owing to the greater toughness of the branches.

The adaptability of individuals to the work of pruning varies greatly and as Mollenhauer [30]

points out the selection of the proper men for the work is just as important for efficiency as the choice of tools. Meyer [29] suggests that a man will demonstrate his ability as a pruner in the first day of work and a good man can be trained to high efficiency in a week. It is of course essential to supply such a man with pruning tools to which he is best adapted providing the tools are satisfactory in other respects.

Pruning Tools.

Investigations have been undertaken in a number of countries with the object of selecting the most efficient and satisfactory implement for forest tree pruning. While the value of the individual tool may vary with species, local conditions, adaptability, and use in dry or green pruning, it has been pointed out that for this purpose the tool must be quick and sturdy in use and efficient in operation [22]. From the recent literature on these investigations it will be seen that the hand saw and pole saw have been given the most general approval, although individual preferences are shown for edge tools and shears.

A special committee was appointed in Sweden in 1936 by the Union of Forestry Societies to make tests of the principal pruning tools used in that and the neighbouring countries [26]. The implements examined consisted mainly of saw and edge-tools cutting on the upward stroke and were designed for pole pruning from the ground up to a maximum height of about 20 ft. Tests on Scots Pine plantations in Central Sweden showed that pruning to that height could be carried out conveniently in three sections, viz. 0–8, 8–13, and 13–20 ft. from the ground, requiring the use of a 3-, 8-, and 13-foot pole, respectively. In general, saws were found more suitable than edge-tools, a conclusion in agreement with German experience [27]. Only in the case of older Scots Pine stands, in which pruning had not been started until the branches had died up to full pruning height, were edge-tools sometimes found more practical for work in the intermediate (8–13 ft.) section, especially in trees with finer boughs. Löf [25] has recommended the use of a light barking spade mounted on a thin pole, the branches being cut off with an upward stroke. In a time study of dry pruning Scots Pine with various types of saws and by various procedures, Junack [23] found it quickest to prune in three stages: (*a*) cutting the lower branches within comfortable reach with a 'vine' saw, which has a slightly curved blade, is 30 cm. long, and has a pistol-grip handle, (*b*) removing middle branches with the same saw on a 1·5 m. handle, also to a convenient reach, and (*c*) cutting the upper branches from a ladder, using the same saw. The middle stage affected only one or two whorls of branches, but was a practical measure, as pruning between the rungs of the ladder was troublesome and time consuming.

Reports from experiments undertaken by the Forestry Commission in Great Britain [16, 34] suggest that for young stands of Scots and Corsican Pine the best tool is the curved pole saw with 4 to 6 teeth per in. In older stands the Swedish knife pruner [described in *Skogen* 17 (589–91)] was found the cheapest and best tool when used from the ground up to a maximum of 18 or 24 ft. by means of a 6-ft. Ash pole and 5-ft. duraluminium extension rods. A heavy hacker was found to be most satisfactory for knocking off dead lower limbs. Beach [4] reports difficulty in obtaining a clean cut with a pole saw above 12 ft. and suggests that a hand saw and light ladder are preferable, the saw being not over 18 in. long, narrow, and with 6 or 8 teeth per in. Ackers [1] recommends the use of a billhook, either on a short or long handle, for forest pruning and points out that the saw is slow for small limbs, makes a rough cut and may damage the cambium of the stem. It may be noted that Jacobs [22] found no harmful effects from saw cuts in Southern Australia over a period of twenty years. Donald [13] points out that within certain limits the rate of occlusion of the pruning wound is probably unaffected by the smoothness of the cut surface.

Investigations of pruning tools have also been made in Australia and New Zealand. Roche and Hocking [37] suggest that for the first six feet of pruning either the axe, slasher or pruning shears may be used though skilled workmen are required for the first two. Above that height a pruning saw is found to be the only satisfactory tool, and a concave, 18-in. blade with 6 teeth per in. and cutting on the pull stroke only has been found most efficient. From experience in pruning *P. radiata*, Williamson [44] described specially made single-blade secateurs and a lance chisel which he found most satisfactory for low and high pruning respectively. The latter implement is placed underneath the branch and, if the branch is large, the lower end of the lance handle is hit with a maul. The axe, shears and the saw have all been tested for pruning in the Australian Capital Territory and the

curved pruning saw was found most satisfactory for gang use, being quick to manipulate and safe in the hands of almost any worker. Shears were found to be fatiguing and not as easy to manipulate as the saw. The axe used by skilled workers is faster than the saw in cutting large, acute branches and it does not gum up. If the axe is used the branch should be removed by a side or upper cut rather than a down cut [22].

In the United States the saw has found favour as a pruning tool with many workers [5, 6, 12, 18, 20, 29, 30, 32, 39]. It is used either as a hand saw from the ground, from a ladder or from the tree itself, or as a pole saw. The axe is considered by many, both there and elsewhere, as a potential danger to the tree and to the operator unless the latter is highly skilled in its use [5, 6, 7, 22, 44] and it is no faster than the hand saw in pruning some species [5]. The type of hand saw that has been found most satisfactory has a narrow, curved, single-edge blade with 5 to 8 teeth per in. and a pistol-grip handle, and cuts either on both strokes [5, 18] or on the draw stroke only [30]. Mollenhauer found such an implement particularly useful for work in close-set limbs of White Pine, used either with a ladder up to the first 15 ft. of bole or by the Tarzan method,* which is particularly effective above 15 ft. The pole saw, with a stiff 14- or 16-in. blade rigidly attached to a pole of the desired length and having 5 to 7 teeth per in. has been found an efficient tool for pruning the middle section (8–17 ft.) of the bole, particularly when the operator has acquired the knack of using it [5, 29].

While the hand saw and ladder method is probably less tiring than the pole saw for high pruning (above 17 ft.) of large branches, the relative efficiency of these two methods for average pruning along the middle portion of the bole will vary with adaptability of the men using them, branching characteristics of different species, and the condition of underbrush and topography [20]. Hawley and Clapp [18], working in Northern White Pine plantations, found that while there was no significant difference in the speed of the two methods, a comparison in quality showed 41 and 4 per cent. of bad cuts (mainly long stubs and ragged lower edges) from the pole and hand saw respectively. Mollenhauer [30] also reports heavy damage from pole saws to trees of this species. In pruning the 8–17 ft. section of Longleaf Pine the quality of work done by a good pole saw was found to be just as high as that done by the best hand saw of those tested [5]. Davis [12], working in Western White Pine, found that the difference in speed between these two methods varied with type of stand. In general the pole saw was preferred for high pruning unless stand density permitted easy movement of ladders or unless the higher limbs were large. For trees over 8 in. d.b.h., and especially those having large branches, the hand saw and ladder method is probably the more efficient [5]. In plantations of *P. radiata* in the Australian Capital Territory the pole saw was found to be the faster at a 6 × 6 ft. spacing while the hand saw and ladder was faster at wider spacings [22].

Hawley and Clapp [19] have reported on a pruning shear that was found to be as efficient as a hand saw for low pruning. This tool is 20 in. in total length, cuts close to the bole, does not wound the tree, and leaves a relatively smooth cut. It has two sharp blades which prevent it from 'creeping' along the branch. Other workers have found this type of implement satisfactory for low pruning [12, 39], and recent improvements in its design are further discussed by Geddes and Erickson [15]. However, it requires the constant use of two hands and is somewhat heavier and possibly more tiring than a saw, and this may offset the advantage of the relatively high speed of the best shears in comparison with the saw on some types of work [20]. Mollenhauer [30] found that the time-cost for pruning dead branches with this type of implement was high, but points out that time might be saved on live branches owing to freedom from gumming.

A tool specially designed for pruning forest tree limbs up to 1 in. in diameter and at a height between 6 and 17 ft. is described by Rich [36], and is mentioned as worth further investigation by Geddes and Erickson [15]. This is made from a flat rectangle of knife steel and is attached to a pole at one side. It has a semi-circular concave cutting edge at top and bottom, and the cut is made by impact, first on the under side of the limb and then on the upper side. Mollenhauer [30] found that this tool required high skill and is best used only on live limbs $\frac{1}{2}$ in. in diameter or less, or on species with thick bark.

A light-weight power-driven pole saw has been developed by the United States Forest Products Laboratories [9, 33]. This unit consists of a 'small gasoline engine, a flexible shafting with housing, and a circular saw', all mounted on some light conveyance. It works without fatigue to the operator,

* By this method the pruner climbs to the height to be pruned, and then works down.

makes a smooth cut and does not leave stubs. The practical value of different types of power pruners is being investigated.

The pruning chisel and pruning knife are little used in the United States. The former is considered clumsy and likely to cause damage, particularly in high pruning, while the latter is of no use for large branches [18]. In testing 21 selected pruning tools in a 25-year-old Northern White Pine stand Mollenhauer [30] found that the double-bitted axe, brush hook, pole shears, and double-blade heavy shears all caused heavy to very heavy damage to the trees and were in general fatiguing to use. The pole axe, when used as a mace, was the most efficient tool for knocking dead branches from the lower section (0–7 ft.) of the bole, although it caused stub holes and broken 'collars', the significance of which was not determined.

Special pruning ladders may add to the efficiency of the operation. Hawley and Clapp [18] suggest the use of light ladders 8 and 12 ft. high, tapering from 2 ft. at the bottom to not over 1 ft. at the top, and having a cloth wound over the top rung to protect the bark. Davis [12] suggests that 11 feet is the best ladder length for the average man. Useful additions to a pruning ladder include (*a*) a band of hose pipe reinforced by wire in place of the top rung, let back some distance from the top of the ladder, giving great stability and reducing tree damage, and (*b*) a wooden platform on small ladders to facilitate low pruning [22].

Application.

In undertaking the actual pruning operation consideration should be given to choice of stand, selection of the trees, time when pruning can best be done in relation to stand age and condition and the season of the year, the degree of pruning, and the technique of cutting the limbs.

In 1936 Mayer-Wegelin completed the most exhaustive survey of pruning experience so far published [27]. His main conclusions with regard to the pruning of Scots Pine under German conditions are as follows. Scots Pine should be pruned artificially unless dense growth and/or shading in youth assure thin branching and sufficiently fast natural pruning. Pruning should be avoided, however, (1) in districts heavily infested with *Trametes pini*—until it is definitely proven that pruning does not increase the risk of infection by this fungus; (2) in stands having a high percentage of badly formed stems, in those where the diameter of the branches of the dominant trees, at a height of 2–4 m. exceeds 3–4 cm.,* and in stands of less than fourth quality class; (3) and in second, third and fourth quality class stands the mean d.b.h. of which exceeds 18, 14, and 10 cm., respectively. Pruning should not take place during the growing season, it should be confined as much as possible to faultless dominant and co-dominant trees, and, as a rule, only dead branches and occasional dying, low branches should be removed. Pruning should be carried out in height sections corresponding to the gradual dying of the branches, and in each new section a smaller number of trees should be pruned than in the one next below. The number of trees to be pruned to a given height should be the greater, the higher the quality and the smaller the mean diameter of the stand, taking the following table as a rough guide.

Mean diameter of the stand at the time of pruning		8–10 *cm.*		10–14 *cm.*		14–18 *cm.*	
		Pruned trees					
Quality class	*Pruning height*	*Number per ha.*	*Spacing*	*Number per ha.*	*Spacing*	*Number per ha.*	*Spacing*
II	0–5 m.	650	4·0 m.	450	4·7 m.	250	6·3 m.
	5–8 m.	400	5·0 m.	250	6·3 m.	—	—
III	0–5 m.	550	4·3 m.	400	5·0 m.	—	—
	5–8 m.	350	5·4 m.	—	—	—	—
IV	0–5 m.	450	4·7 m.	—	—	—	—
	5–8 m.	—	—	—	—	—	—

* In light of new evidence, Mayer-Wegelin reduced this figure in 1938 to 2–3 cm. [28].

The stems should be selected and marked in the summer preceding pruning and thinning, preferably in June, when it is easy to spot trees attacked by *Coleosporium seneconis*, the pruning of which should be avoided. The pruning cut should be smooth, vertical, and flush with the stem. Care should be taken not to wound the bark of the bole.

With reference to Swedish conditions Löf [25] states that pruning should be done on good soils only, in stands not more than 30 years old, and that it should be carried out in conjunction with thinnings. A number of trees varying with site quality (about 350 per ha.) should be carefully chosen for quality and uniform distribution and marked before thinning. They should not much exceed 10 cm. d.b.h. and should be free of large branches containing heartwood. It is suggested that the exact time of year for pruning is unimportant provided that the tree is functioning actively. Winter is unsuitable owing to the brittleness of frozen branches. Branches should be cut off with an upward stroke of a sharp pruning iron, not hacked or wrenched off, the cut being close in to the outer bark and no protruding splinters left on the cut surface.

Pruning studies in Great Britain have been conducted in recent years by the Forestry Commission and the Forest Products Laboratory, Princes Risborough. As far as the technique of pruning Scots Pine is concerned, the preliminary results obtained, and the recommendations made [13, 16, 34] do not differ materially from Mayer-Wegelin's conclusions.

In the United States recommendations in regard to the pruning of White Pine include the selection of trees that are dominant, not much over 3 to 4 in. d.b.h., well formed, free from injuries and disease, having small branches, and being of vigorous growth. For economic reasons selected trees should be limited to the final crop, that is 150 to 200 or 300 trees per acre [6, 18]. Cline and Fletcher[6] suggest that the first pruning in White Pine should be delayed until the dominants can be selected and it can be ascertained that the butt log will be straight. If treatment is started before the stand has closed it may be necessary to make a first pruning (up to 7 ft.) on all the trees, as it is impossible to select crop trees until the dominants have become differentiated [21]. This practice is also advocated in Australia and New Zealand to be followed by a selection of 100 to 250 trees per acre for the final pruning operation [37, 44]. Davis [12] suggests that the best time to begin pruning Western White Pine is when the average measurements of the stand are 5 in. d.b.h. and 30 ft. high, when pruning can be taken up to $7\frac{1}{2}$ ft. Meyer [29] found that 3 to 6 in. d.b.h. was the best size for pruning White and Red Pine. However, for fast-growing species that are being managed on a short rotation for the production of clear lumber, the sooner the dead branches are removed the better [33].

While the height to which final pruning may be carried is directly correlated with the expected final diameter at that height [8], cost is the factor that usually limits pruning height in second-growth stands or plantations. Such stands are generally grown on a short rotation and pruning is often confined to the butt-log length plus a trimming allowance or a total of 17 ft., which will include a large proportion of the tree's volume. Again the size of the unpruned core may vary with a number of factors, in particular length of rotation, but the usual practice is to restrict it to 6 in. or less. In order to keep the knotty core at a fairly uniform diameter throughout the butt log the pruning should be made in two or more operations two or three years apart. As pointed out by Donald [13] 'a balance has to be struck between keeping down the core diameter, the crown requirements of the tree, and the cost of pruning in several stages at short intervals'. Hawley and Clapp [18] suggest a schedule of three pruning operations at 0–7 ft., 7–12 ft., and 12–17 ft. up the stem, each operation removing only those living branches not in direct sunlight, and going up to but not including the highest interlacing branches of adjoining crowns. In plantations that have not closed but are ready for pruning, it is suggested that the branches in the lower $\frac{1}{6}$ to $\frac{1}{4}$ of the length of the living crown can be safely removed.

While Mayer-Wegelin [27] indicated that under German conditions the pruning of Scots Pine should, as a rule, be confined to dead branches and occasional dying, low branches, his book contains little evidence against live pruning. There have been various opinions in the past on the question of live versus dry pruning, but at the present time the majority find little fault in the removal of a properly controlled percentage of the living crown. The relation between live pruning and growth has already been discussed briefly. Hawley and Clapp [18] favour the pruning of small branches while still alive as a means of minimizing insect and fungus damage and of producing a better grade of timber. They report that in a 6 × 6 ft. White Pine plantation the stubs less than $\frac{1}{2}$ in. in diameter

cut close to the trunk will heal over completely within 10 years, whereas larger stubs take longer. Anderson [3] has suggested that the removal of the lower branches of Scots and Corsican Pine while they are still alive, and before the bark has roughened, will add to the efficiency and ease of operation. Two other points, which relate to the speed of occlusion of pruning wounds, favour green pruning: (*a*) that pruning should take place while the tree is putting on wide growth rings, and (*b*) that the growth rings of the stem tend to turn outward to meet the live branch tissue, while they dip inward in the immediate vicinity of a dead branch stub [22, 31].

The time of year when small, live limbs and dead branches are removed from White Pine does not matter greatly though it is possibly better to prune in the dormant season [6, 18, 20]. In Australia it has been found quite practical to prune at any time of the year [17, 37], although it has been suggested that winter is probably the most favourable and spring the least favourable season for this work [22]. In Great Britain the early spring is considered the best time for pruning [4].

When sufficient information has been obtained as to management policy, relative value of species, sizes and qualities, growth conditions, &c., a pruning schedule may be drawn up giving the most desirable programme for each combination of the variables of species, site and spacing [8, 22]. Such a schedule will show the number of trees to be pruned per acre and the height to which pruning will be carried at a stated age, and should indicate the maximum pruning allowable under any given set of conditions. Craib [8] points out that information necessary in drawing up pruning schedules includes initial mean d.b.h. of trees pruned, increment of pruned trees prior to felling, height of pruned trees at various ages, thinning regimes, length of rotations, and taper and bark thickness at various heights of pruned trees.

In the actual cutting of the branches care must be taken not to leave protruding stubs or to tear the bark from the tree. The length of branch stub is an important factor in determining the rate of occlusion [13]. The exact point at which the cut can best be made is a matter of discussion and experiment. While most investigators favour close pruning some are opposed to cutting through the 'collar' or shoulder of the branch [6] as this may expose a large area of wood and there is danger of girdling the tree, particularly with species such as White Pine on which the branch collars may form a complete ring around the bole [18]. With reference to *P. radiata* Jacobs [22] suggests that the pruning cut in a green branch should be made flush with the outside of the bark on the shoulder, and that the shoulder should not be cut or bruised as this will increase the size of the wound. He found that a girdling which covered only a quarter of the circumference of the tree had a definite adverse effect on diameter increment.

In the hope of speeding up the rate of occlusion and of preventing the entrance of insects and decay into pruning wounds, a few workers have experimented with cutting through the branch collar. Curtis [10] has pointed out that there is a considerable delay in healing after the pruning of a dead branch without cutting into the bark of the tree, as there is a minute gap between the branch base and the surrounding wood which has to be filled by diameter growth of the bole before callus can form over the cut surface of the branch. Paterson [31] has explained that in dry pruning the occluding tissue is obtained through activity of the trunk cambium only, whereas both trunk cambium and that at the base of the branch contribute to the occlusion of live branch stubs. Results from experiments in pruning dead branches of White Pine indicate that a saw cut close to the stem, which extends into the green tissue surrounding the dead stub, will hasten callus formation, and incidentally the cross-section area of the dead branch is reduced as the branch tapers towards the centre of the bole. Furthermore, the pitch flow induced by this method of pruning may well lessen the possibility of fungus attack [10]. Adams and Schneller [2] have found that, when live branches were pruned by saw through the branch base (as close to the tree as the saw could be held), 98 per cent. formed callus at the end of the first growing season following pruning, whereas live branches that were saw-pruned without injury to the branch base or that were removed with point-cut pruners showed less than 25 per cent. callus formation. It was also found that pruning through the branch base was effective in increasing rate of callus formation for dead branches, particularly those dead less than four years. Anderson [3] found that both living and dead branch stubs healed over more quickly as a result of pruning close to the bole of the tree through the branch collar, although this operation was found to be more difficult for Scots and Corsican Pine than other conifers. Beach [4] also recommends pruning flush with the stem unless there is danger of girdling the tree. It is recognized that pruning

through the branch base reduces the speed of operation but the relative importance of this fact is not fully known.

A New Technique in Pruning.

A fundamentally new technique of raising Pine timber without knots has been developed by Krotkevitch [20] at the Kiev Forestry Research Institute. On plants that are about 8 years old, 1·5 m. high and have already formed 4–5 whorls of branches, all the lateral buds of the main shoots are removed each spring. This is continued until the trees reach a height of about 6–7 m., which on first quality sites at Kiev takes about 10–12 years. Any summer shoots formed are also removed. Thereafter the crowns are allowed to develop freely. In this way Krotkevitch succeeded in raising young Pine trees that were entirely straight and free from knots. This method is illustrated by the accompanying drawing. The removal of the lateral buds does not influence height growth but it does result in an 18–25 per cent. increase in diameter growth and in a greatly stimulated development of needles on the main shoot. These needles supplement the nutrition derived from the branches at the base of the trees during the 'bud-pruning' period. Once the upper crowns have formed a canopy the low branches lose their importance and can be removed unless they are pruned naturally. Further stand treatment includes freeing the crowns of pruned trees and the introduction of an understorey of shrubs, &c., for soil protection. For 400 trees per ha. 60–80 man-hours are required to develop clean boles 6 m. long. The work is done by women and youths with the aid of specially constructed simple tools and portable ladders 4 m. high. Krotkevitch claims the following advantages for his method: (1) The possibility of growing ideally clean Pine timber for the aeroplane and plywood industries on a rotation of 30–40 years. (2) Higher timber volume production than in the case of ordinary pruning. (3) No risk of infection by insects or fungi since the small wounds are covered almost immediately with a drop of resin and occlude completely within a few weeks. (4) The method is simpler than ordinary pruning.

From photograph in Krotkevitch's paper. Height growth in cm. is shown for 4 consecutive years.

Krotkevitch's technique is still in an experimental stage. It may be of interest to note that the removal of buds in connexion with pruning was an essential part of the English eighteenth century method of 'finger-budding' or 'foreshortening', but at that time buds were pinched off from branches which it was desired to check or to eliminate, and this was done mainly for improving the shape of Oak trees [11].

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ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

0. GENERAL FORESTRY

01. BIBLIOGRAPHY

01. **Classified list and index of information on woods operations contained in the publications and circulars issued by the Woodlands Section, Canadian Pulp & Paper Association, 1927–38.** Woodlands Section, Canadian Pulp & Paper Association, Montreal. [*Woodlands Section Index* No. 451 (H–3).] 1938. pp. 18. With a supplement bringing entries up to date to Jan. 1940. pp. 11.

02. LISTS OF VERNACULAR NAMES

02 : 12.2 (91.1). KEITH, H. G. **Additions to the preliminary list of North Borneo plant names.** (*North Borneo Forest Records* No. 2). Forest Department, Sandakan, North Borneo. 1940. pp. 4–7.

05.3 *Annual Reports*

05.3 (410). **Foresters' record.** *Quart. J. For.* 34, 1940 (116–21).

Brief analysis of 13 schedules of observations for the year 1939 from a number of districts in Great Britain. The observations refer mainly to seed years, frequency of mammals and birds, diseases, seasonal damage, and conditions in nurseries and plantations.

05.3 : 86 (59.1). BURMA. **Report on forest administration in Burma (excluding the Federated Shan States) for the year ending 31st March, 1939.** Supt., Govt. Printing & Stationery, Rangoon. 1940. pp. 203.

05.3 (728.2). BRITISH HONDURAS. **Trade and information report for quarter ended 31st March, 1940.** Govt. Printer, Belize. 1940. pp. 5.

05.3 (73). UNITED STATES. **Annual report of the Director of the Civilian Conservation Corps, fiscal year ended June 30, 1939.** U.S. Govt. Printing Office, Washington, D.C. 1939. pp. 123 + tbls.

05.4. *Yearbooks*

05.4 : 09.4 (47.1). **The Finland Year Book 1939/40.** OY. Suomen Kirja, Helsinki. 1939. pp. 464.

The book contains an article on forestry by M. Lappi-Seppälä and one on the Finnish woodworking industries by Lauri Kaila. Most of the statistical information is brought up to 1937 and 1938 but particulars on timber and forest resources are still based on the 1921–4 survey, the results from the 1936–8 survey not being yet available. The indications are, however, that there have been no radical changes in the position. Stocks in the east and to a lesser degree in the north appear to have decreased as against an increase in the west, and Pine stands have fallen, while Spruce and Birch woods have increased in extent.

05.4 : 09.4 (52 : 51). **The Japan-Manchoukuo Year Book 1940.** The Japan-Manchoukuo Year Book Co., Tokyo. 1940. pp. 1232.

Both the Japan and the Manchoukuo sections include a chapter on forestry containing numerous statistical data on production, utilization, and foreign trade. Over one half of the area of Japan proper is covered with forests but the mountainous character of the country seriously impedes extraction from numerous localities and until the outbreak of the Sino-Japanese hostilities imports of timber (mainly building timber from the U.S.A. and from Canada) exceeded exports. The war increased the demand for mining timber, pulpwood, and railway sleepers both for inland consumption and for export to North and Central China, while substantially decreasing the consumption of building timber and of other categories of material, and in 1938, for the first time since 1920, timber exports exceeded imports. In

order to mitigate any harmful effects that may arise from the present situation, the Forest Law has been amended in the sense of stricter State control and more centralized administration.

In recent years a good deal of afforestation has been carried out in Japan with a view to creating woodlands in easily accessible localities and, on the whole, there has been a steady increase in the area under forest as can be seen from the following table.

Area of forests by ownership in Japan proper
(*Unit:* 1,000 *Cho;* 1 *Cho* = ·992 *ha.* = 2·45 *acres*)

	Crown forests	*State forests*	*Communal forests*	*Temple and Shrine forests*	*Private forests*	*Total*
1918 . .	1,392	7,681	4,278	126	8,817	22,293
1921 . .	1,421	7,277	4,118	130	9,096	22,043
1924 . .	1,376	7,755	4,329	132	9,623	23,215
1927 . .	1,361	7,764	4,283	131	9,363	22,903
1930 . .	1,445	7,702.	4,221	143	9,693	23,203
1933 . .	1,426	7,721	4,323	145	10,227	23,843
1936 . .	1,380	7,713	4,445	153	10,496	24,186

The forest area, exclusive of moorlands, of Manchoukuo was estimated in 1938 at 21,943,000 ha., which is about 1·4 times the total area of Japan proper, but the exploitation of forest resources still lags behind the steadily increasing consumption of timber and in 1938 over 20 million Yen were spent on imports from Japan (1 Yen = approximately 2 sh. 0½d.)

'Percentage forests' i.e. small State forests managed by adjoining villages or towns, which are allowed in return a certain percentage of the produce, are being gradually converted into communal forests, but there are still some 12,000 of these in Japan and their total area amounts to about 40,000 ha. Though of small economic importance, the 'percentage forests' are of some interest in as far as they represent a very unusual type of land tenure.

07. EDUCATION AND RESEARCH

07 : 05.3. **Triennial programme of work for the Forest Research Institute, Dehra Dun, for 1939–42.** Govt. of India Press, New Delhi. 1940. pp. 32.

09.2. *Pre-history*

09.2 : 12.19.2 (71.1). HANSEN, H. P. **Palaoecology of two peat bogs in southwestern British Columbia.** *Amer. J. Bot.* 27, 1940 (144–9). [Oregon State College, Corvallis.] O.B.D.

Pollen analyses of two post-Vashon bogs in southwestern British Columbia show that the pioneer post-glacial forests consisted largely of Lodgepole Pine, suggesting an initial cool and damp period. This was followed by a Spruce-Pine forest with a predominance of Spruce, indicating an increase in moisture and temperature. A third period of decreasing moisture and temperature is marked by the increase and dominance of Douglas Fir and Hemlock, which has persisted to the present. Climatic interpretations are tentative but agree essentially with those of pollen analyses of other bogs in the Pacific Northwest. *From author's summary.*

09.2 : 12.19.2 : 11.2 (77.5). HANSEN, H. P. **Post-glacial vegetation of the driftless area of Wisconsin.** *Amer. Midl. Nat.* 21, 1939 (752–62). [University of Washington, Seattle.] L.S.

In this region post-glacial forest succession, as indicated by pollen analyses of three peat bogs, apparently developed through an initial stage of *Abies*/*Picea*/*Pinus*, followed by a *Pinus*/Deciduous stage and a final stage of Deciduous/*Pinus* with some prairie in recent times. This suggests an initial cool period followed by a warmer period that has probably remained uniform to the present, though the presence of grass in the upper third of the spectrum may reflect a slight desiccation. *From author's summary.*

09.2 : 31.1 : 12.2 (69). LOUBIÈRE, A. Anatomie comparée d'un bois de Dicotylédone crétacique de Madagascar. [**Comparative anatomy of the wood of a Cretaceous dicotyledon from Madagascar.**] *Bull. Mus. Hist. nat., Paris,* Ser. 2, 11, 1939 (484–7). [F.] O.R.S.

A description is given of a fossil wood found in Middle Cretaceous strata at Anjobajoha, near Marovoay, Madagascar. The wood structure closely resembles that of *Acer* and the fossil has therefore been named *Acerodendron madagascariense* Loub.

09.2 : 31.1 : 12.2 (69). LOUBIÈRE, A. Sur un bois triasique de Madagascar. **[On a Triassic wood from Madagascar.]** *Bull. Mus. Hist. nat., Paris*, Ser. 2, 10, 1938 (651–5). [F.] K.

A fossil coniferous wood from Morafenobe, Madagascar, is described and named *Araucarioxylon decaryi*.

09.4. *Forest Statistics*

09.4 : 98.3 (410). WATSON, Sir H. **Imports of timber to the United Kingdom.** *Emp. For. J.* 19, 1940 (74–6).

Revised figures are published for the quantities and value of timbers imported during 1938. A table is given to show the quantities of hewn and sawn hardwoods, by species and countries, imported in 1937 and 1938, as compared with the averages for the period 1926–30.

09.4 : 94.1 (47.2–6). MATYUK, I. S. **The forestry situation in the State forests of the U.S.S.R.** *Lesnoe Khozyaystvo, Moscow* 1940 (5), (4–7). [R.]

Of the 685·3 million ha. of forests which are nominally under the management of the People's Commissariat for Forests, only 55·8 million ha. have been surveyed and organized so far, and even for the surveyed resources statistics are not entirely reliable, since subsequent records of selection fellings and of areas devastated by fire or atmospheric agencies have not been kept accurately. Previous to 1939 the surveying of forests made slow progress but in that year inventories were made on 5·2 million ha. and the rate of work is being further accelerated in the current year. 71 and 73·9 per cent. of the total timber volumes produced in 1937 and 1938, respectively, were obtained from clear fellings. It is intended to raise the proportion of clear fellings to 94·5 per cent. within the next five years, and, in particular, to abandon as soon as possible the practice of primitive selection cuttings in which only the best stems are removed. Clearing of lop and top was carried out on 52·5, 73·9, and 87·3 per cent. of the felled areas in 1937, 1938, and 1939, respectively. Fires occurred on 865,500 ha. in 1937, 1,137,500 ha. in 1938, and 1,083,800 ha. in 1939. The rise was due to a large increase of forest fires in Asiatic Russia while in European Russia forest fires decreased considerably during the same period, thanks to improved control measures. Fire-devastated and felled areas which were un-regenerated by the beginning of 1938 totalled 70·6 million ha. in all and 4·6 million ha. in European Russia, and there is no doubt that a large proportion of these areas will have to be regenerated artificially. The extent to which artificial regeneration is carried out at present is negligible. The figures for 1939 are:—area sown, 3,523 ha.; area planted, 3,450 ha.; area on which natural regeneration has been supplemented artificially, 4,358 ha.; total, 11,331 ha. Other matters to which insufficient attention has been given so far are thinnings and the control of diseases and insects. In some instances huge volumes of dead material have been left in forests after fires and these have developed into centres of infestation.

09.4 : 32 (485). Undersökning av skogsavverkningen i riket. **[An investigation on fellings in Sweden during 1937.]** *Svenska SkogsvFören. Tidskr.* 38, 1940 (61–104). [Sw. f.]

Statistics of Swedish fellings during 1937, based on returns made for tax assessment, are tabulated and discussed. The total quantity of wood felled for sale was 45,600,000 cu. m. solid measure with bark, not including branches and stumpwood. Though the returns do not record the quantity of wood felled for home use, this is estimated at about 8,000,000 cu.m., bringing the total cut to 53 or 54 million cu.m. The total annual increment of Swedish forests is in the neighbourhood of 56,600,000 cu.m.; thus the 1937 fellings were not on the whole excessive, though in the northern regions there seems to have been some overcutting. *From author's summary.*

09.4 (497.1). ABEL, E. Les forêts de la Yougoslavie. **[The forests of Yugoslavia.]** *J. for. suisse* 91, 1940 (104–6). [F.]

09.4 : 98.1 (71 : 73). **Lumber distribution and consumption in Canada and the United States, 1938.** Forestry Branch, Census of Industry, Dominion Bureau of Statistics, Ottawa. 1940. pp. 23. [E.F.]

09.4 (71.1). KNAPP, F. M. **Forestry in British Columbia. The present and future**

of timber supplies. *Timb. News Sawm. Chron.* 48, 1940 (130, 134).

The estimated total stand of merchantable timber in British Columbia at present is 254 billion bd. ft., the most valuable of which is 155 billion bd. ft. along the coast. Of this some 110 billion ft. are accessible under present logging conditions. The total cut for lumber, pulpwood and other products in 1939 was 3,300,000,000 bd. ft. of which over 50 per cent. was Douglas Fir. This was 35 per cent. in excess of the cut allowable under sustained yield management. In addition, during the past two years an average of 500,000 acres of forest land has been burned over annually. As Douglas Fir bears seed irregularly at intervals of 3 to 7 years, and as the maximum distance seed is carried from an uncut stand of timber is ¼ mile, the clear cutting of large blocks of this species will leave much of the area without natural regeneration.

09.4 : 09.7 (729.4). NICOLAS, S. **Forestry and forest resources in Haiti** [cont.]. *Carib. For.* 1 (3), 1940 (20–2). [E.span.]

Haiti's 300 sq. miles or so of fairly dense *Pinus occidentalis* constitute a forest resource of great potentiality. Re-afforestation of abandoned farm lands is urgently needed for soil and water conservation, and for protection from dry trade winds during the winter months.

09.4 : 35 : 98.3 (73). STEER, H. B. **Stumpage and log prices for the calendar year 1938.** *Statist. Bull. U.S. Dep. Agric.* No. 71, 1940. pp. 63. [U.S. Forest Service.]

09.4 (75.6). CRUIKSHANK, J. W. **Forest resources of the northern coastal plain of North Carolina.** *For. Surv. Release Appal. For. Exp. Sta.* No. 5, 1940. pp. 48.

09.4 (79.5). MORAVETS, F. L. **Forest statistics for Coos County, Oregon.** Pacific Northwest Forest & Range Experiment Station, Portland, Oregon. 1940. pp. 17.

09·4 (79.7). BUELL, E. D. **Forest statistics for Pacific County, Washington.** Pacific Northwest Forest & Range Experiment Station, Portland, Oregon. 1939. pp. 18.

09.4 (79.7). BUELL, E. D. **Forest statistics for Pierce County, Washington.** Pacific Northwest Forest & Range Experiment Station, Portland, Oregon. 1939. pp. 17.

09.4 (79.7). COWLIN, R. W., and MORAVETS, F. L. **Forest resources of Washington.** Division of Forestry, Department of Conservation and Development, State of Washington. 1940. pp. 44. [Pacific Northwest Forest & Range Experiment Station.]

09.4 (91.4). **Forest resources of the Philippines.** Commonwealth of the Philippines Department of Agriculture & Commerce. Manila. 1939. pp. 46. P.R.

09.7. *Monographs of Individual Forest Regions*

09.7 (43.8). HUECK, K. Der Wald im ehemaligen polnischen Staatsgebiet. **[The forests of the former State of Poland.]** *Forstarchiv* 15, 1939 (387–97). [G.] L.S.

09.7 : 09.4 (43.8). BUCHHOLZ, E. Rückblick auf die Forstwirtschaft Polens 1918–39. **[Retrospect of forestry in Poland, 1918-39.]** *Forstarchiv* 15, 1939 (419–34). [G.] [Reichsinstitut für ausländische und koloniale Forstwirtschaft.] L.S.

09.7 : 12.2 (44). GAZIN, C. J. Les sapinières du département des Vosges. **[The Silver Fir woods of the Département des Vosges.]** *Rev. Eaux For.* 78, 1940 (143–56). [F.]

Description, past and present management, and volume and money yield of these forests. At present each stand is treated on its own merits, and both selection and floating periodic block management are practised. The local designation for such management is 'Traitement varié'.

09.7 : 6 : 94.3 (54.2). SINHA, J. N. **The Dhalbhum Forest Division. An experiment in private forest management.** *Indian For.* 66, 1940 (340–5).

The Dhalbhum Forest Division in Bihar consists of 165·9 sq. miles of forest belonging to the Dhalbhum Estate and 14·4 sq. miles of State-owned forest. Details are given of the 45-year leasehold agreement made in 1936 between the Government and the owner of the Estate, whereby the Government manages the forest and pays the owner a rent and half the net profits, subject to certain conditions and reservations, among which the owner agreed to forgo his rental for the first 5 years.

A brief statement is given of revenue and expenditure to date. Under the circumstances, the owners will be receiving financial returns from 1941 onwards, and though the Government will incur a loss for some time after that date, it is regarded as certain that the forest will eventually pay handsomely. If some such arrangement had not been made, the forest would quickly have become derelict.

09.7 : 12.2 (54.5). AHMAD, M. S. **Karnpur and Bindraban Bamboo forests.** *Indian For.* 66, 1940 (273–84, 350–64).

A descriptive account is given of the past and present management of Karnpur and Bindraban Bamboo (*Dendrocalamus strictus*) forests, Hoshiapur District, Punjab, and of the extraction, marketing, and utilization of their produce.

09.7 : 12.2 (59.1). ALLSOP, F. **Kyetpyugan Teak Plantation, Insein Forest Division, Burma.** *Emp. For. J.* 19, 1940 (43–7).

The Kyetpyugan Teak plantations were started in 1865 with a view to producing concentrated stocks of Teak timber in readily accessible localities for export. Unfortunately the site was ill-chosen and capable only of producing inferior quality of Teak suitable only for local supply. Past treatment of the plantations is described and the results to date of felling and replanting with a view to the supply of local requirements of Teak and Pyinkado [*Xylia dolabriformis*] are given. *Author's summary.*

09.7 (68.9). KELLY EDWARDS, E. J. **Forestry in Southern Rhodesia to-day.** *Emp. For. J.* 19, 1940 (90–6). *Repr.* from *Proc. Rhodesia sci. Ass.* 36, 1938.

The history of forestry in Southern Rhodesia prior to the introduction of Responsible Government in 1923 is briefly reviewed, and a more detailed account is given of progress between that date and 1937. The chief forest statistics of 1923 and 1937 are tabulated for comparison. Although at the end of this period the excess of consumption over net increment had increased, improvements in methods of utilization and the greater increment obtainable from the expanding area of exotic plantations should make it possible to remedy this situation.

09.7 : 12.19.2 : 23.21 (728.5). HARDING, R. E. **Notes on the Pacific Coast region of Nicaragua.** *Carib. For.* 1 (4), 1940 (30–1). [E.span.]

09.7 : 92 (729.3). SCARFF, J. G. **Forestry and forest legislation in the Dominican Republic.** *Carib. For.* 1 (3), 1940 (4–9). [E.e.span.]

The forest area of the country is estimated at 3,007,000 ha. or 60 per cent. of the total area. The ten most important species are listed as *Swietenia mahagoni* (L.) Jacq., *Zanthoxylum flavum* Vahl., *Guaiacum officinale* L., *G. sanctum* L., *Chlorophora tinctoria* Gaudich., *Haematoxylon campechianum* L., *Phyllostylon brasiliensis* Cap., *Cedrela odorata* L., *Juniperus gracilior* Pilger and *Pinus occidentalis* Sw. The three main forest types are the tropical rain forest along the eastern half of the northern coast, the xerophytic thorn-hardwood-softwood type along the southwestern coast and extending inland throughout the provinces of Barahona and Azúa, and the Pine-hardwood forest of the central mountains in the provinces of Trujillo, La Vega, and Santiago. Wood imports have dropped off in recent years owing to a decrease in construction and increased utilization of native species. A summary is given of the forest legislation of 1934 and suggestions are made for advancing forestry.

09.7 : 6 : 2 (79.1). PEARSON, G. A., and WADSWORTH, F. **Timber management in the Fort Valley Experimental Forest, Wing Mountain Unit.** *Res. Rep. Sthwest. For. & Range Exp. Sta.* No. 1, 1940. pp. 21.

09.7 : 12.19 (923). BLOEMBERGEN, S. Verslag van een exploratie-tocht naar de eilanden Timor en Wetar. **[Report on a forest-botanical exploration of the islands of Timor and Wetar.]** *Tectona* 33, 1940 (101–96). [Du.e.] (Also published as *Korte Meded. BoschbProefst.* No. 71, 1940).

A detailed report on a tour made in March–April 1939 to study the forest vegetation of these islands. Various forest types are described and a general survey is given of the vegetation. Tables are appended to show the uses and durability of the various kinds of wood as reported by natives, the uses of other parts of plants, and the scientific and vernacular names of the species collected by the author.

11.1. *Atmosphere*

11.12. Pressure and Movement

11.12 : 12.19.2. Fons, W. L. **Influence of forest cover on wind velocity.** *J. For.* 38, 1940 (481–6). [California Forest & Range Exp. Sta.]

Variation in wind velocity as influenced by height above ground and vegetation was studied in three common types of cover: grassland, brush, and even-aged Ponderosa Pine. The wind-velocity distribution is shown to be distinctly different in each cover type studied. The results indicate that the wind velocities at any two heights bear a linear relation to each other, and that the linear slope and intercept are dependent on the temperature difference between the two levels and on the height of the lower level above the ground surface. The wind velocity is greatly decreased at the top of the crowns and remains nearly constant in the canopy. In general the velocity of the wind in the forest is not a constant percentage of the velocity above the tree crowns. For midday conditions, when the air temperature decreases with height, this percentage decreases as the wind velocity above the crown increases. *From author's summary.*

11.4. *Soil*

11.41. Soil Physics

11.41 : 11.11 (74.6). Kienholz, R. **Frost depth in forest and open in Connecticut.** *J. For.* 38, 1940 (346–50). [Connecticut Department of Forestry, C.C.C.]

A study of frost penetration and emergence in the open and in the forest was made during the winters 1937–38 and 1938–39 in northern Connecticut at an altitude of 1,225 ft. Among the facts determined were: (1) Frost penetrated about twice as deep in the open as in the forest. (2) Forest floor material lessened the depth of frost penetration, retarded the time of freezing of the mineral soil, and retarded the time of frost emergence. (3) With one exception frost did not begin to emerge from the ground in either forest or open until the snow cover had completely disappeared. (4) In every case the frozen soil began to thaw out from both the bottom and the top at the same time. *From author's summary.*

11.42. Soil Chemistry

11.42 : 11.44. Meurice, R., and Cartiaux, J. Contribution à la connaissance du chimisme des matières humiques. **[Chemical tests of humic substances.]** *Bull. Inst. agron. Gembloux* 8, 1939 (168–71). [F.flem.g.e.] L.S.

A complex humic-acid substance was extracted from a woodland soil and its reaction with lime water was studied.

11.42 : 11.46 : 12.19.2 (74.7). Chandler, R. F. **Cation exchange properties of certain forest soils in the Adirondack section.** *J. agric. Res.* 59, 1939 (491–505). [New York (Cornell) Agricultural Exp. Sta.] O.R.E.

On soils of similar geological origin, the Sugar Maple/Beech/Yellow Birch forest type produced a soil type which, in the surface layers, was less podsolized, had a higher pH value, and a larger percentage of base saturation than that found under stands of the Red Spruce/Sugar Maple/Beech type, or the Red Spruce type. The differences between the latter two types were small. Evidence is submitted to indicate that the cause of these differences was associated with the calcium content of the foliage of the trees.

A high correlation existed between total exchange capacity and percentage loss on ignition. Percentage base saturation and pH value were highly correlated for soils of similar organic-matter content. The apparent pK value of the soil organic matter was found to be lower than that of the mineral soil. The values were somewhat higher for the hardwood profiles, indicating that weaker acids were involved. The lower apparent pK value of organic matter, and hence the higher percentage base saturation at a given hydrogen-ion concentration, explained why it was possible to have a lower pH value in the B_1 horizon than in the A_2 horizon of a humus podsol profile. *From author's summary.*

11.42 : 12.12 : 21.3. Jacks, G. V., and Scherbatoff, H. **The minor elements of the soil.** *Tech. Commun. Imp. Bur. Soil Sci.* No. 39, 1940. pp. 86.

11.43. Biology of Soil, including Mycorrhiza

11.43 : 12.11 : 21.4 : 12.2. Harley, J. L. **A study of the root system of the Beech in**

woodland soils, with especial reference to mycorrhizal infection. *J. Ecol.* 28, 1940 (107–17). [Department of Botany, University of Oxford.]

Two main kinds of root system were distinguished on Beech growing on the Chiltern Hills. (*a*) Shallow root systems on morphologically shallow soils and raw-humus soils that are physiologically shallow; and (*b*) deep root systems on the deepest escarpment soils and the better plateau soils. The frequency of fine roots in the surface layers of the soil and the degree of mycorrhizal infection increased with increasing accumulation of raw humus, i.e. under conditions where the C/N ratio was high and available N low. Analyses of buds and leaves from adult trees indicated that the supply of N to trees on chalk escarpment soils was greater than to those on raw-humus plateau soils, in spite of the high N content of root systems, due to greater mycorrhizal infection, in the latter. This difference is presumably a result of the higher N content, better incorporation of litter, and speedier N mobilization in the escarpment soils; hence, though there is no evidence that infection does not increase N absorption, it cannot at all events overcome the poor rate of N supply on the raw-humus soils. Chemical analyses and estimates of the soil microflora showed that the raw-humus soil in which mycorrhiza was most abundant was characterized by low Ca and K, less available P, a higher concentration of ferrous Fe, and fewer micro-organisms than in the better soils; thus the degree of mycorrhizal infection must be viewed as a function of the soil system. The trees were least vigorous on soils where mycorrhizas were either abundant or few, and most vigorous on intermediate soils where mycorrhizas were present in moderate numbers only; hence such variations in vigour are not attributable primarily to differences in the number of mycorrhizas or to conditions affecting their formation, but rather to the available rooting depth of the soil.

11.43 : 12.2 : 43 (67.5). HENRARD, P. Reáction de la microflore du sol aux feux de brousse. Essai préliminaire exécuté dans la région de Kisantu. [**Effects of brush fires on the soil microflora. Preliminary study made in the Kisantu region.**] *Publ. Inst. nat. Étude agron. Congo Belge, Sér. sci.* No. 20, 1939. pp. 23. [F.] Pl. Sci. Lit. 11 (4), (19)

11.44. Soil Cover. Ground Flora. Litter. Surface Humus

11.44 (74.2). BALDWIN, H. I. **Humus types on the Fox Forest.** *Fox Forest Notes*, No. 18, 1939. p. 1.

Humus types that are developing under a variety of forest types and soil-moisture conditions on an area that is largely in transition from abandoned farm land to forest. It appears that the effect of the 1938 hurricane, in exposing soil and changing forest types, will improve the quality of humus.

11.44 : 12.19.2 : 12.2 (485). ROMELL, L. G. Den nordiska blåbärsgranskogens produktion av ris, mossa och förna. [**Litter production and annual growth of Blaeberry bushes and mosses in northern Spruce woods.**] *Svenskbot. Tidskr.* 33, 1939 (366–82). [Sw.e.] K.

The greatest dry weight recorded for one year's sprout growth of Blaeberry (*Vaccinium myrtillus*) under 200- to 250-year-old Spruce in Sweden was 0·44 metric tons per ha., of which a half represented young leaves, and a half green twigs and stems. As the shrubs had not regained their former height and vigour and the leaves were not fully developed, this figure must be regarded as a minimum for a year's growth. The total dry weight of a year's growth of all moss species (chiefly *Hylocomia*) corresponded to 0·7 metric tons per ha., and the greater development of shoots of former years indicated that this too is a minimum value. A moss growth of 0·7 tons per ha. equals the dry weight of about 1·7 cu. m. of Spruce wood, whereas the average yearly increment in northern Sweden is only 1·6 cu. m. per ha.; thus much of the northern Spruce forest must produce more moss than wood. When the above figures are combined with an estimated annual needle fall of 0·6–0·7 metric tons dry weight per ha., the total annual litter production from Spruce needles, Blaeberry leaves, and mosses, amounts to 1·5–1·6 metric tons per ha., which is surprisingly high for forests of such poor growth. The few available data on the nutrient content of Blaeberry and moss litter show that it is very rich in nutrients. The moss litter is poor in lime, but this is balanced in the combined litter by the high lime content of the Spruce needles. The high P_2O_5 content of the mosses cannot be accounted for by absorption with the soil water, and it seems probable that the mosses may obtain

this and other soluble nutrients directly from the Blaeberry and Spruce litter that falls upon the moss carpet.

11.46. Relationship of Plants to the Soil

11.46 : 12.11. SALTER, R. M. **Some soil factors affecting tree growth.** *Science* 91, 1940 (391–8). [Ohio State University.]

A general discussion of certain root/soil relationships with particular reference to soil structure, moisture relations, availability of soil nutrients, and soil aeration.

11.47. Maintenance of Favourable Soil Conditions

11.47 : 97.4 (43.1–5). GERTH, G. Die Liefermöglichkeiten von Gesteinsmehl als Bodenverbesserungsmittel und ihre Bedeutung für die Gesteinsaufbereitungsanlagen. **[The possibilities of rock meal as a soil improver, and their significance for the rock-quarrying industries.]** *Forstarchiv* 15, 1939 (435–6). [G.] L.S.

From research to date it appears that the powder of basic igneous rocks can be usefully employed in the manuring of seedlings on poor soils, provided the size of the rock grains does not exceed 2 mm. It is estimated that very large quantities of such material are available in Germany for forestry purposes.

11.48-9. Kinds and Types of Soil

11.48–9 (729.7). HARDY, F. **A provisional classification of the soils of Trinidad.** *Trop. Agric., Trin.* 17, 1940 (153–8). [Imperial College of Tropical Agriculture.]

11.6. *Hydrographical Conditions including Erosion*

11.6 : 11.44 : 11.41. JOHNSON, W. M. **Infiltration capacity of forest soil as influenced by litter.** *J. For.* 38, 1940 (520). [Rocky Mt. Forest & Range Exp. Sta.]

Infiltration studies were made with a North Fork infiltrometer on sandy, podsolized soils averaging 30 in. in depth on a slope varying from 5 to 13 per cent., with and without a litter layer of Ponderosa Pine needles and twigs about 3 in. deep. When the litter was undisturbed, the average infiltration capacity was found to be 1·52 ± 0·16 in., whereas with the litter removed the average capacity was 0·92 ± 0·10 in. This difference was found to be highly significant. Measurement of the influence of other soil factors such as thickness of duff, humus, transition layer and A_2 horizon on infiltration capacity indicated that only the thickness of the transition layer had a significant effect, the thicker the layer the greater the capacity.

11.6 : 11.46. COOPERRIDER, C. K., and HENDRICKS, B. A. **The role of vegetation on steep mountain slopes.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 85, 1940. pp. 3.

During a recent torrential summer storm in the Sierra Ancha Experimental Forest, Arizona, some bare spots no larger than 30 ft. in diameter became the source of destructive surface run-off and mud-flow that ran downwards through well-revegetated areas, opening former gullies and causing new destruction.

11.6 : 96 (54.1). BENGAL. **Report of the West Bengal Forest Committee.** Supt., Govt. Printing, Alipore, Bengal. 1939. pp. 165.

A detailed report is presented on the work and recommendations of the Western Bengal Forest Committee, appointed in 1938 to study problems of deforestation and erosion in this region.

12.1. *General Botany*

12.11. Physiology. Biology [including Genetics]

12.11 : 11 : 12.2. NAVALKAR, B. S. **Ecology of mangroves. I. Determination of osmotic pressure of *Avicennia alba* Blume.** *J. Univ. Bombay* 8 (2), 1940 (58–74). B.C.P.A. 1940, A., III (545). P.R.

12.11 : 12.14–5. CHANDLER, R. F. **The calcium content of the foliage of forest trees.** *Mem. Cornell agric. Exp. Sta.* No. 228, 1939. pp. 15.

The seasonal trends in the calcium content of the foliage of *Fagus grandifolia*, *Magnolia acuminata*, *Populus tremuloides*, *Juniperus virginiana*, and *Pinus strobus*, were studied. In all cases the calcium content, expressed either on a percentage or on an absolute-amount basis, was found to increase progressively throughout the growing season. The calcium content of the foliage of evergreen trees increased throughout the growing season but remained fairly constant during the winter months. The longer the foliage of a single

species remained on the tree, the higher was its calcium content.

The calcium content of mature foliage of twenty-seven forest trees was determined and they were grouped accordingly: (1) Species averaging more than 2·0 per cent. of calcium in their foliage—Tulip Poplar, Red Cedar, Basswood, Black Locust, Mockernut Hickory, Bitternut Hickory, White Cedar, Hop Hornbeam, Trembling Aspen, White Ash, and Black Cherry. (2) Species whose foliage contained from 1·0 to 2·0 per cent. of calcium—Shagbark Hickory, American Elm, Sugar Maple, Norway Spruce, White Oak, Red Oak, Yellow Birch, Chestnut Oak, White Pine, and Balsam Fir. (3) Species whose foliage contained less than 1·0 per cent. of calcium—Red Maple, Red Pine, Hemlock, Beech, Scotch Pine, and Red Spruce. *From author's summary.*

12.11 : 12.2. RIOU, P., and DELORME, G. L'érable à giguère est-il véritablement un érable ? **[Is *Acer negundo* really a Maple?]** *Nat. canad.* 67, 1940 (87–90). [F.] [Commercial High School, Montreal.] N.H.M.

Investigations in Quebec showed that the iron and manganese contents of the stem, branches, and bark of *A. negundo* closely resembled corresponding figures for species of *Fraxinus*, while differing considerably from those of other *Acer* species.

12.11 : 07. SNOW, A. G., and DUFFIELD, J. W. **Genetics in forestry.** *J. For.* 38, 1940 (404–8). [Northeastern Forest Exp. Sta.]

It is emphasized that seed origin and seed-tree selection are only a part of the field of forest genetics and that actual research on trees is necessary before the principles of genetics can be applied to forest tree improvement. [Cf. *For. Abs.* 1 (137)]. The line of research suggested is controlled breeding with the object of (1) producing individuals having desirable qualities, and (2) collecting information on the mode of inheritance of certain characteristics. Some of the problems that require investigation are set down and discussed briefly.

12.11 : 12.15 : 2. SCHREINER, E. J., and HUBERMAN, M. A. **Induced flowering—a tool for mass selection, progeny tests, and forest management.** *J. For.* 38, 1940 (491–2). [Northeastern Forest Exp. Sta.]

If inherently excellent individuals of such forest tree species as produce seed at irregular intervals or in alternate years (e.g. White Pine, Oak, Hickory) could be induced to flower and produce seed in the years when the majority of trees in the stand are without flowers, then a large portion of the seedlings would be of the desired parentage, and furthermore a measure of control could be obtained over two-parent progeny tests. The possibilities of this procedure are discussed in relation to forest management. The authors express the hope that research will be undertaken on methods of stimulating flower production, particularly in the species mentioned.

12.11 : 12.2 (79). WEIDMAN, R. H. **Evidences of racial influence in a 25-year test of Ponderosa Pine.** *J. agric. Res.* 59, 1939 (855–87). [California Forest & Range Exp. Sta.] O.R.E.

Ponderosa Pines raised from seed collected in 20 localities in the western United States and grown in northern Idaho were measured at intervals up to 1935, when they were 22-26 years old from seed. Differences in number of needles per fascicle, needle length, general appearance of foliage, and thickening of hypoderm were found among groups derived from 5 different regions delimited on the basis of precipitation. Such differences and differences in rate of growth corresponded to differences among the trees of the parent localities. Diameter and height growth showed pronounced variation, the slowest-growing progenies making only half as much growth as the most vigorous. Best growth was made by trees derived from seed sources resembling the planting site in climate, and poorest growth by those from localities with a more severe climate, these tendencies being less marked in the one progeny that was derived from a region with a milder climate. Persistence of needles was not found to be hereditary, though there was strong evidence that characteristics of internal needle structure were inherited. The findings emphasize the importance of correct provenance, and suggest that the most suitable range of seed sources for Ponderosa Pine to be grown in northern Idaho extends from the Colville locality in Washington, eastward a little beyond the Continental Divide, and from the Salmon River to the Canadian boundary. *From author's summary.*

12.11 : 12.2 (485). NILSSON-EHLE, H. Jätteaspen. Den moderna svenska skogsförädlingens

upptäckt. **[The Giant Aspen. The recent Swedish discovery in forest improvement.]** *Nord. Familjeboks Månadskrönika* 1 (2), 1938. pp. 6. [Sw.] Pl. Breeding Abs. 10 (884).

A description is given of the stand—probably a clone from root suckers—of male triploid Aspens (*Populus tremula gigas*) found in 1935 at Bosjökloster, Skåne. The giant strain seemed to compete much more successfully with other local trees than did the common Aspen. Its greater size and vigour as compared with the latter, and other distinctive features such as its reported rot resistance, are discussed. Tests have shown the value of the wood for the match industry and paper manufacture. Finds of Giant Aspens in other Swedish localities are recorded. In a northern region the annual rings, though smaller than in the southern localities, still maintained the same relative superiority in comparison with the ordinary Aspen. The variation that exists within the group is noted and the importance of a reconnaissance of existing stands in Sweden is emphasized. Rapid utilization of the new form is facilitated by its capacity for reproducing by root suckers, but large-scale production would also require a good output of triploid seedlings obtained by crossing tetraploid and diploid forms. Tetraploids already obtained by the author are expected to flower in 2 or 3 years. The Swedish Forest Tree Breeding Association is working on the same lines.

12.11 : 12.2 (485). NILSSON-EHLE, H. Framställning av skogsträd med ökat kromosomtal och ökad virkesproduktion. **[Production of forest trees with increased chromosome number and increased timber yield.]** *Svensk PappTidn.* 1938, No. 2. pp. 5. [Sw.] Pl. Breeding Abs. 10 (883).

In 1936–37 pollinations of common Aspen by the giant form gave one extremely vigorous plant that proved to be tetraploid ($2n = 76$). The rest of the progeny included diploids, aneuploids (with $2n = 38$–57), and some triploids (with 57 or about 57 chromosomes) which were also very vigorous. The tetraploid, which is now 83 cm. high. has leaves $2\frac{1}{2}$ times as big as those of the diploid sibs and bigger than those of the triploids. The practical importance of the tetraploid is that triploid seedlings of Giant Aspen can now be produced at will by crossing it with the diploid form, and such triploids should prove far superior in timber production to diploids growing under the same conditions. It still remains to be discovered whether the tetraploid occurs in nature and whether it has any direct importance as a timber tree. When such questions are settled, systematic hybridization within the tetraploid group might be used in improvement work.

12.11 : 12.2 (485). BERGSTROM, I. **On the progeny of diploid × triploid *Populus tremula* with special reference to the occurrence of tetraploidy.** *Hereditas, Lund* 26, 1940 (191–201). Pl. Breeding Abs. 10 (882).

Two triploid *gigas* forms of *Populus tremula* were crossed with a diploid female type. In the 91 plants raised from one of these crosses, one was tetraploid ($2n = 76$) and the rest ranged from the diploid number of 38 to the triploid number of 57, the mode being $2n = 50$. Nine plants had 38-39 chromosomes and were thus approximately diploid. The diploid and approximately diploid plants were relatively vigorous and normal in appearance, and many of the triploids and hypotriploids exhibited *gigas* characters, though plants with intermediate aneuploid numbers were lacking in vigour. The tetraploid was vigorous and had large, broad leaves. The usual relationship between stoma size and chromosome number was observed. In the second triploid × diploid cross no tetraploid was found in a progeny of 20 and the plants were of poor development.

12.11 : 12.2 (71). HEIMBURGER, C. **Report on Poplar hybridization II. 1937 and 1938.** *For. Chron.* 16, 1940 (149–60). [Dominion Forest Service, Ottawa.]

Results are reported of further progress in a poplar hybridization project initiated in 1935 with the aim of producing valuable hardy and disease-resistant material of rapid growth for the production of wood of high quality for industrial purposes, and of value for shelterbelts in the Prairies. It has been possible to cross the native Aspens of Eastern and Western Canada with several exotic Aspens, and their hybrids with Silver Poplar, and to obtain hybrid material of great promise for these purposes. Some Western Balsam Poplars have also been crossed with exotic species and have yielded hybrids of promise for shelterbelts. An attempt to cross an Aspen with a Cottonwood has so far yielded indifferent results. The cross of a Basket Willow with a Cottonwood was not successful. Hardiness, disease resistance, and good propagability from stem

or root cuttings are at present the most important characters used in evaluating the young hybrids. *Author's summary.*

12.11 : 12.13 : 12.2. BRANSCHEIDT, P. Befruchtungsphysiologische Untersuchungen an *Taxus baccata* L. **[Research on the physiology of fertilization in *T. baccata*.]** *Ber. dtsch. bot. Ges.* 57, 1939 (495–505). [G.] O.B.D.

An interim report on the germination of pollen and the development of pollen tubes and male gametic cells of *Taxus baccata* in culture media supplemented with various substances.

12.11 : 12.15 : 12.2. COOK, D. B. **Cone production by young trees in New York.** *J. For.* 38, 1940 (369). [New York State Conservation Department.]

In 1936 trees of *Larix americana* in a New York plantation flowered when 8 years old, though no filled seed was produced, and since that date increasing numbers of cones have been produced every year. In 1937 three trees of *L. decidua* in the same plantation produced a total of 50 cones at 9 years of age. The 1,500 seeds extracted from these were sown and produced sixteen 2–0 seedlings. The parent trees grew on a rather poor soil under a continental climate with a minimum temperature of – 23° F. and a growing season of 164 days.

12.12. Pathology

12.12 : 11.14 (42.9). THOMSON, T. **The ice storm of January 27–29, 1940. Serious damage on the Ceiriog Forestry Experimental Area.** *Quart. J. For.* 34, 1940 (107–11). [University College of North Wales, Bangor.]

12.12 : 11.14 (410). GARDNER, R. C. B. **The ice storm of January 27–29, 1940.** [Second notice]. *Quart. J. For.* 34, 1940 (122–4).

12.12 : 11.14 : 21 (74.4–5). WYMAN, D. **Salt-water injury of woody plants resulting from the hurricane of September 21, 1938.** *Bull. Arnold Arbor.*, Ser. 4, 7, 1939 (45–52). K.

This account, based on observations made in Massachusetts and Rhode Island, consists mainly of lists (i) of trees and shrubs that had been submerged in salt water for at least 24 hours after the hurricane and were recovering satisfactorily one year later, (ii) of those subjected to salt spray without injury or with no serious injury, (iii) of those killed or very seriously injured by salt water.

12.12 : 11.14 : 21 (74). Moss, A. E. **Effect on trees of wind-driven salt water.** *J. For.* 38, 1940 (421–5). [University of Connecticut].

Investigations following the New England hurricane of 1938 showed that woody vegetation is subject to injury from wind-blown salt water even if diluted by heavy precipitation, and that the effect of wind-driven salt may be easily detected to a distance of 45 miles from the ocean on especially sensitive foliage when wind velocities are well over 100 miles per hour. The injury occurs only where the specimen is exposed to direct force of wind and may appear on foliage, which turns a red-orange colour before falling, or on overwintering buds, or on woody stems in semi-dormant condition. There is a wide range in resistance of species, both hardwood and softwood, such species as White Pine, Tulip (*Liriodendron tulipifera*) and Sour Gum (*Nyssa sylvatica*) being highly susceptible, whereas Colorado Blue Spruce (*Picea pungens*), Austrian Pine (*Pinus nigra*), Red Pine, Pitch Pine (*P. rigida*), and Horse Chestnut (*Aesculus hippocastanum*) are among the relatively resistant species. The effect is more serious on tree species that do not possess the ability to produce coppice growth. *From author's summary.*

12.12 : 11.16 : 12.2. PEACE, T. R. **An interesting case of lightning damage to a group of trees.** *Quart. J. For.* 34, 1940 (61–3). [Imperial Forestry Institute, Oxford.]

At Buskett's Lawn, in the New Forest, about 6 large Douglas Firs, together with a small Oak and several small Beeches growing in the same group, began to fail in October 1936 and died during the next summer. Some of the branches of neighbouring trees were also injured. The dead trees gave no evidence of fungal attack or damage to the root system. The living trees near by showed canker and die-back of the branches. From the cankers only *Phomopsis occulta*, which was non-parasitic, was isolated; the base of the branches yielded the parasitic species *P. pseudotsugae*. Both fungi, however, were secondary to an injury that had occurred in the early summer of 1936, when much abnormal wood had been formed on the canker sites. Thunderstorms occurred during this period, and it is presumed that lightning killed the entire cambium of the dead trees and damaged that of trees near by.

The absence of burning or splitting probably points to the occurrence of a multiple discharge of low intensity, which would satisfactorily account for the symptoms.

12.12 : 11.47 : 21.3. SMOLÍK, L. **Natural ferromanganiferous concretions as a remedy for chlorosis.** *Transactions of the Fourth Commission of the International Society of Soil Science, Stockholm.* 3–8. vii. 1939. (95–7). [E.e.] [Agricultural Exp. Sta., Brno.]

The application of crushed ferromanganiferous concretions, extracted from podsolized soils, cured chlorosis of pear trees in southern Moravia.

12.12 : 12.2 (77.7). GILMAN, J. C., and MCNEW, G. L. **Fungi associated with tree cankers in Iowa. II. *Diaporthe, Apioporthe, Cryptodiaporthe, Pseudovalsa* and their related conidial forms.** *Iowa St. Coll. J. Sci.* 14, 1940 (129–53). [Iowa Agricultural Exp. Sta.]

12.12 : 12.2 : 24.4 (76.4 : 76.6). WRIGHT, E. **First progress report on the *Phymatotrichum* root rot losses in experimental windbreaks of Oklahoma and Texas.** *Plant Dis. Reptr.* 24 (1), 1940 (13–20). R.A.M. 19 (403–4).

Experimental windbreaks planted in Oklahoma and Texas were inspected during 1939 for root rot due to *Phymatotrichum omnivorum*. *Ailanthus altissima* showed nearly 100 per cent. survival in a locality where severe infection was present. *Juglans nigra, J. major, Sapindus drummondii*, and Apricot also showed resistance. Apparently no species that can be used in windbreaks on infected soil will prove to be immune. In general, seedlings are more susceptible than older trees.

12.12 : 12.2 (52). HEMMI, T., and AKAI, S. **Pathological studies on *Polyporus rhodophaeus* Lév.** *Ann. phytopath. Soc. Japan* 9, 1939 (199–210). [Jap.e.] R.A.M. 19 (372–3).

Japanese broadleaved trees acting as hosts to this fungus are listed. Various species of Cherry have been reported as the most common hosts, but *Robinia pseudoacacia* also appears to be among the most susceptible tree species. In *Robinia* decay due to the fungus begins in the sapwood and spreads inwards, often in an irregular manner, so that the heartwood may be attacked while portions of the sapwood are still sound. The fungus is classed in the 'corrosion' group, and the optimum temperature for mycelial growth is between 31° and 32° C.

12.12 : 12.2 (73). CAMPBELL, W. A., and DAVIDSON, R. W. ***Ustulina vulgaris* decay in Sugar Maple and other hardwoods.** *J. For.* 38, 1940 (474–7). [C.C.C. & Bureau of Plant Industry.]

Sprout Sugar Maple is readily infected by *U. vulgaris* through parent stumps 6 in. or more in diameter, or more commonly through dead companion sprouts. The upward extent of decay from this fungus is relatively high, the rot column decreasing rapidly in diameter. In the typical stage the rot becomes brittle, white, and interspersed with prominent zones of thin, black, carbonaceous sheets of fungus material. As incidence of this fungus is relatively small no specific control measures are considered necessary.

12.12 : 12.2 : 13.2 (494). HOSSLI, H. Die gefährliche Weisstannenlaus, *Dreyfusia nüsslini* C.B. in höheren Lagen. [***Dreyfusia nüsslini* C.B. at high altitudes.**] *Schweiz. Z. Forstw.* 91, 1940 (88–90). [G.]

A number of new centres of infection are reported at elevations ranging from 800 to 1400 m., in spite of well over 1100 mm. rainfall in all these centres. It is now definitely established that *D. nüsslini* can cause serious damage up to at least 1000 m. above sea level.

12.12 : 12.2 (63). CASTELLANI, E., and CICCARONE, A. Osservazioni su un micromicete del 'Ciat' (*Catha edulis* Forsk.). [**Notes on a micromycete of *C. edulis* Forsk.**] *Nuovo G. bot. ital.* 46, 1939 (611–4). [It.it.] L.S.

Description of *Dielsiella pollaccii* (Elisei) Cicc. and E. Cast. (*Cycloschizon pollaccii* Elisei), found on leaves and branches of *Catha edulis* Forsk. in Italian East Africa and Abyssinia.

12.12 : 12.2. SMITH, C. O. **Susceptibility of species of Cupressaceae to crown gall as determined by artificial inoculation.** *J. agric. Res.* 59, 1939 (919–25). [California Agricultural Exp. Sta.] O.R.E.

Cultures of *Bacterium tumefaciens* isolated from *Prunus persica* produced galls on *Cupressus, Juniperus*, and *Thuja*. Cultures from *Salix* sp. produced galls on the same genera and on *Thujopsis*. Those from *Libocedrus decurrens* gave negative results on all species

except *L. decurrens*. Sixteen species of *Cupressus* proved susceptible to inoculation; on *C. glabra* and *C. montana* occasional knob-like growths, but no typical galls, were formed; one species, *C. guadalupensis* was apparently resistant. Galls were produced on *Juniperus virginiana*, *J. phoenicea*, and on one plant of *J. procera*, but only small knob-like growths on *J. hibernica* and *J. cedrus*. *Libocedrus decurrens* and the 3 species of *Thuja* tested proved susceptible. The original plant of *Thujopsis dolabrata* was negative in response, but rooted cuttings from it developed typical rough galls. *Chamaecyparis lawsoniana* developed non-typical overgrowths. Control punctures on the various hosts healed over in a normal manner. The results are not conclusive because of the differences in the environmental conditions of the plants tested and the small number of inoculations on some of the species. *From author's summary.*

12.12 : 12.2. Baraney, A. V. **Ash canker caused by *Endoxylina astroidea* Fr.** *Lesnoe Khozyaystvo, Moscow* 1940 (4), (50–2). [R.]

Serious damage is reported from a number of steppe districts. The disease appears to have existed in Russia for some 30–35 years, but so far has not been studied. *E. astroidea* was first described by Romell in Sweden (*Bot. Notiser* 1892).

12.12 : 12.2. Seeler, E. V. **Two diseases of *Gleditsia* caused by a species of *Thyronectria*.** *J. Arnold Arbor.* 21, 1940 (405–27). [Arnold Arboretum, Harvard University.]

Thyronectria austro-americana (Speg.) Seeler causes a rapid, fatal wilt in *Gleditsia japonica* Miq., and a slow-acting localized canker disease of *G. triacanthos* L. Details are given of the diseases and of the causal fungus.

12.12 : 12.2. Ashplant, H. ***Hevea brasiliensis* and disease resistance.** *India Rubb. J.* 99 (11), 1940 (274–6). Pl. Sci. Lit. 11 (17), (6).

12.12 : 12.2 (73). Hahn, G. G. **Distribution and hosts of Cedar blight in the United States. Reports of Cedar blight in 1939.** *Plant Dis. Reptr.* 24 (3), 1940 (52–8). R.A.M. 19 (444).

Red Cedar (*Juniperus virginiana*) blight, caused by *Phomopsis juniperovora*, is now known to occur in 25 States of the American Union and in the District of Columbia. New hosts include *J. japonica*, *J. chinensis* var. *mas*, *J. horizontalis* var. *douglasii*, and *J. ashei*; while *J. virginiana* var. *pyramidiformis hillii* has given evidence of resistance in recent tests. During 1939 the blight was destructive in Minnesota and Wisconsin, but in the western States, Nebraska, Kansas, Oklahoma, and Texas, it has been of little importance in recent years. In Nebraska and Kansas, where it was previously virulent, the succession of dry seasons may have contributed to the lack of serious infection.

12.12 : 12.2 (485). Junell, S. Granens rostsvampar. **[The rust fungi of Norway Spruce.]** *Skogen* 27, 1940 (179–81). [Sw.]

Brief descriptions are given of *Chrysomyxa woronini*, *C. ledi*, *C. pyrolae*, *C. abietis*, and *Pucciniastrum padi*, and of their life histories so far as known. Direct proof is lacking of the identity of the presumed life stages and the alternate hosts of the first three species, two of which, *C. woronini* and *C. ledi*, may be conspecific. The author appeals to all interested in the subject to send in fully annotated specimens of these rusts on any of their host species.

12.12 : 12.2. Ehrlich, J., and Opie, R. S. **Mycelial extent beyond blister rust cankers on *Pinus monticola*.** *Phytopathology* 30, 1940 (611–20). [School of Forestry, University of Idaho.]

Microscopic measurements of the longitudinal extent of mycelium of *Cronartium ribicola* showed that in each case it extended beyond the outer limits of surface discoloration with a considerable variation in range, from under 0·5 cm. to over 3·0 cm. with a mean of 1·66 cm. No practical mean difference was found between proximal and distal measurements.

Mycelial extent was found to be variously correlated with estimated age of canker, stage of canker, thickness of bark at outer limits of surface discoloration, and diameter of cankered internode at outer limits of surface discoloration. This latter is believed to be a useful factor for field estimation of mycelial extent. *From authors' summary.*

12.12 : 12.2 (78.8). Shear, C. L., and Davidson, R. W. **A new species of *Dothiora* on Aspen and Willow.** *Mycologia* 32, 1940 (105–11). R.A.M. 19 (444).

An account is given of *Dothiora polyspora* n. sp., found on branches of Aspens and Willows in Colorado.

12.12 : 12.2 (45). SERVAZZI, O. Contributi alla patologia dei Pioppi. VII. Su alcuni micromiceti pioppicoli. **[On the pathology of Poplars. VII. Some Poplar-inhabiting micromycetes.]** *Boll. Lab. sper. R. Oss. Fitopat., Torino* 16, 1939 [issued 1940] (86–96). [It.] R.A.M. 19 (444).

An annotated list of 25 fungi, mostly common saprophytes, found on this host in Italy.

12.12 : 12.2 (45). SERVAZZI, O. Appunti di fitopatologia. **[Phytopathological notes.]** *Boll. Lab. sper. R. Oss. Fitopat., Torino* 16, 1939 [issued 1940] (19–32). [It.] R.A.M. 19 (387).

Owing to intensely cold weather, spring defoliation of Poplars due to *Pollaccia elegans* [*For. Abs.* 1 (141)], did not occur in 1939, though light leaf infections were found. On withered shoots the author found the fungus he formerly identified as *Didymosphaeria populina*, for which he considers the correct name to be *Venturia populina* [*For. Abs.* 1 (141, 241)], and this fungus was also obtained in culture from isolations of *P. elegans*. *Pollaccia radiosa* (*V. tremulae*) was found on *Populus alba* and on a self-sown Poplar, probably a hybrid of *P. alba* and *P. tremula*.

12.12 : 12.2. POMERLEAU, R. **Studies on the ink-spot disease of Poplar.** *Canad. J. Res.* 18, Sec. C, 1940 (199–214). [Department of Lands & Forests, Quebec.] P.R.

Populus tremuloides is the chief suscept of the ink-spot foliage disease caused by *Sclerotinia bifrons* [E. & E.] Whetzel, though occasional infection of *P. nigra*, *P. grandidentata*, and *P. canadensis* has also been noted. The present paper reviews the life history and ecology of the fungus on the basis of observations made during an outbreak in 1935–37. Conditions favouring an outbreak are:—presence of a fairly large number of sclerotia on the ground, occurrence of a dense stand of young Poplars, low temperature and high humidity before and at the time of leafing. The absence of one or more of these conditions may often restrict the attack. During an outbreak numbers of trees at the sapling stage are killed and others severely defoliated, but such effects are noticeable only in pure thickets of Aspen, which are usually the first stage of natural reforestation in Quebec. The more vigorous, taller trees are rarely affected severely enough to be killed.

12.12 : 12.11 : 12.2. CHRISTENSEN, C. M. **Studies on the biology of *Valsa sordida* and *Cytospora chrysosperma*.** *Phytopathology* 30, 1940 (459–75). [University Farm, St. Paul, Minnesota.]

The pycnidia and conidia of *V. sordida* developed in the field and in the laboratory could not be distinguished from those of *C. chrysosperma* produced under comparable conditions, and while isolates of *V. sordida* and *C. chrysosperma* differed among themselves in culture, there was no consistent difference between those of the former as a group and those of the latter as a group.

Collections of *Cytospora* from hosts other than *Populus* could not be distinguished from collections of *C. chrysosperma* from species of *Populus* when compared as to structure of pycnidia, rate of growth on agar, and general cultural characters. *From author's summary.*

12.12 : 12.2. SMITH, C. O. **Galls on *Pseudotsuga macrocarpa* induced by *Bacterium pseudotsugae*.** *Phytopathology* 30, 1940 (624). [University of California Citrus Exp. Sta.]

Inoculation of *Pseudotsuga macrocarpa* with a culture of *Bacterium pseudotsugae* produced aerial galls similar to those described on *P. taxifolia* by Hansen and Smith [*Science* 77 (628)]. Galls were also produced by means of inoculation on *P. taxifolia* var. *glauca* but not on *Abies concolor*.

12.12 : 12.2 (410). CARTWRIGHT, K. St. G. **Note on a heart rot of Oak trees caused by *Polyporus frondosus* Fr.** *Forestry* 14, 1940 (38–41). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

The butts and stumps of two Oaks felled in the Forest of Dean were found to be affected with a white rot that had originated in the heartwood. The rot resembled the 'partridge wood' caused by *Stereum frustulosum*, but the white pockets were less pronounced and decay in advanced stages was more of the stringy type. Where decay was less advanced the limit of the decayed wood tended to be outlined by a reddish 'water-soaked' zone like that associated with *Stereum spadiceum*. Orange zone lines occurred in some places. Though it was not possible to make an analysis of decay in the log, it appeared that the rot column tapered upwards and would probably have affected the bole to a height of 6–8 ft. above ground. As there were no scars at the base of the trees, infection would seem to have taken place through a root. The causal fungus was identified in culture as *Polyporus frondosus* Fr.,

a species that has not previously been recorded as the cause of serious heart rot of living trees in Great Britain, though not uncommon at the base of dead broadleaved trees. Brief descriptions are given of the fungus in the wood and in culture.

12.12 : 12.2. MILBRATH, J. A. ***Coryneum* blight of Oriental Arborvitae caused by *Coryneum berckmanii*, n.sp.** *Phytopathology* 30, 1940 (592–602). [Oregon State College.]

A fungus described as *Coryneum berckmanii* n.sp. attacks several varieties of *Thuja orientalis* and also *Cupressus sempervirens*. Red copper oxide or basic copper sulphate applied as a spray once before the early fall rains is a satisfactory method of control for this disease.

12.12 : 12.2. AHRENS, W. E. **The practicability of detecting Dutch Elm disease by trunk sampling.** *Phytopathology* 30, 1940 (521–7). [Bureau of Plant Industry, U.S.D.A.]

Satisfactory tools and methods have been developed for removing samples ½ in. in diameter and suitable for culturing from trunks of Elms suspected of having Dutch Elm disease. Dormant-season sampling was less expensive than intensive summer scouting.

Several studies of trunk sampling during the growing season indicated that approximately 80 to 92 per cent. of infected Elms showing foliar symptoms could be found by trunk sampling about two weeks after symptoms were observed. Those with vascular discoloration insufficient for detection were usually not severely affected by the disease. Apparently trunk sampling during the dormant season at 6-inch intervals did not injure the trees, since (*a*) the growth increment of sampled trees during the year following sampling was not retarded; (*b*) none of the commonly recognized fungi associated with decay of living trees was isolated from platings of wood adjoining healed and unhealed trunk-sample wounds. *From author's summary.*

12.12 : 12.2 : 13.2 (51). MURAYAMA, J. Notes sur les scolytides du Manchoukuo. **[Notes on the Scolytid beetles of Manchukuo.]** *Annot. zool. jap.* 18, 1939 (137–44). R.A.E. A28 (302).

Species causing considerable injury to forest trees are:—*Scolytus ratzeburgi* Janson on *Betula japonica* var. *mandshurica*, *Ips* (*Pityogenes*) *bistridentatus* Eichh. on *Pinus tabulaeformis*, and *I. acuminatus* Gylh. on *P. tabulaeformis*, *P. koraiensis*, and *Picea jezoensis*. A new species, *Cryphalus jeholensis*, is described from *P. tabulaeformis*.

12.12 : 13.2 (729.5). MARTORELL, L. F. **Some notes on forest entomology.** *Carib. For.* 1 (3), 1940 (23–4). [E.span.]. [Agricultural Exp. Sta., Rio Piedras, Puerto Rico.]

The following recent infestations are reported: (1) The Spanish Elm lacewing bug (*Monanthia monotropidia*) on the leaves of Spanish Elms (*Cerdana alliodora*), (2) the bean lacewing bug (*Corythuca gossypii*) on the leaves of West Indian Satinwood (*Zanthoxylum flavum*) and other species of *Zanthoxylum*, (3) the long scale (*Ichnaspis longirostris*) on the lower branches and leaves of *Swietenia macrophylla*, and (4) the mealybug (*Pseudococcus nipae*) on the leaves and branches of *Sterculia apetala*.

12.12 : 12.2 : 13.2 (52). INOUYE, M. **On eight conifer aphids occurring in Hokkaido (including new species).** *Insecta matsum.* 13, 1939 (132–42). R.A.E. A28 (320).

12.12 : 12.2 : 13.2 (51–2 : 57). KÔNO, H., and SAWAMOTO, T. Über den Artnamen der an Sachalintannen und Yezofichten schädlichen *Dendrolimus*-Art. **[On the specific name of the species of *Dendrolimus* that infests *Abies sachalinensis* and *Picea jezoensis*.]** *Kontyû* 13, 1939 (229–30). [Jap.] R.A.E. A28 (263).

Dendrolimus sibiricus Tshtv., *D. jezoensis* Mats., and *D. albolineatus* Mats. are said to be synonyms of *D. superans* Btlr., which is widespread in Sakhalin, the southern Kurile Is., Japan, Siberia, and Manchuria. The larvae feed on *Tsuga*, *Abies*, *Picea*, and *Larix*, but only rarely on *Pinus*.

12.12 : 12.2 : 13.2 (76). SNYDER, T. E. **The browning of the needles of young Yellow Pine trees in the Gulf States by a leaf-feeding beetle (*Colaspis pini* Barber).** *Sth. Lumberm.* 160 (2020), 1940 (46). [Bureau of Entomology & Plant Quarantine, U.S.D.A.]

The adult beetle feeds along the edges of one-year-old needles causing first the ends of the needles to turn brown and later a complete browning on many trees. The injury usually occurs on small trees of natural reproduction over areas of concentrated feeding up to 10 acres and on scattered trees over 500 acres. The injury may retard growth, particularly where the soil is dry and of poor quality. Lead-arsenate

spray has been used successfully for control on plantations but the cost is not justified.

12.12 : 12.2 : 13.2 (74). PARR, T. J. ***Matsucoccus* sp., a scale insect injurious to certain Pines in the northeast (Hemiptera-Homoptera).** *J. econ. Ent.* 32, 1939 (624–30). R.A.E. A28 (351–2).

The species dealt with occurs in the north-eastern United States and feeds mainly upon *Pinus rigida*. *P. echinata*, *P. pungens*, *P. virginiana*, and *P. ponderosa* are also attacked, but *P. strobus*, *P. banksiana*, *P. sylvestris*, *P. nigra* var. *austriaca*, *P. mugo*, and *P. resinosa* are immune. The biology of the insect and the effects of infestation are discussed. Where a population has built up over a period of years the trees may be considerably damaged or killed. On a sample plot of 19-year-old trees in Pennsylvania 43 per cent. lost their leaders in 1938 and there was evidence that the insect had been killing leaders for at least 8 years. On another plot 74·2 per cent. of the trees lost leaders in 1938 and growth has practically ceased. Trees of all ages are attacked, but destruction is greatest among trees 10–30 ft. high. No natural enemies of the adult insects are known, but a thrips, a bug, and larvae of a Clerid have been found feeding on the eggs.

12.12 : 12.2 : 13.2 (922). DOCTERS VAN LEEUWEN, W. M. Een mijtgal op de vrouwelijke kegels van *Podocarpus neriifolia* Don. **[A mite gall on the female cones of *P. neriifolia* Don.]** *Natuurwet. Tijdschr.* 21, 1939 (333–8). [Flem.e.] L.S.

Abnormal structures on female trees of this species, assumed by previous authors to be male catkins developing on some or all of the receptacles, are in reality galls provoked by a species of *Phytoptus*. The galls are fully described and illustrated.

12.12 : 12.2 : 13.2 (410). CALLAN, E. McC. **'Witches' brooms' on the Cricket-bat and other Willows.** *Forestry* 14, 1940 (22–6). [Imperial College of Agriculture, Trinidad.]

'Witches' brooms', attributed to the gall mite *Eriophyes triradiatus* Nalepa, were found more abundantly on Willows in south-eastern England and the Midlands than farther north. *Salix fragilis* was attacked more frequently and usually more severely than other species. 'Witches' brooms' were also found on Cricket-bat Willow (*S. alba* var. *caerulea*) but they are not regarded as a serious pest to this tree. Other species attacked were ×*S. viridis*, *S. alba* and *S. babylonica*, but none have been found on *S. triandra*, *S. purpurea*, *S. viminalis*, and *S. caprea*. *From author's summary.*

12.12 : 51. CAMPBELL, W. A. **Damage from increment borings.** Bureau of Plant Industry, U.S. Department of Agriculture, Washington, D.C. 1939. pp. 7. [Civilian Conservation Corps.]

Considerable discoloration and localized decay were associated with unplugged increment borings in some species, especially in Beech, Paper and Yellow Birch, and Sugar Maple, while little or no damage occurred in others. No information is available as to whether plugging the borer holes will reduce damage in susceptible species.

12.13. Embryology

12.13 : 12.2. DOYLE, J. **Gymnospore formation in *Sequoia sempervirens*.** *Nature, Lond.* 145, 1940 (900).

12.14. Morphology. Anatomy. Histology

12.14 : 31.1 : 31.22. PFENNIGER, L., and FREY-WYSSLING, A. Über die Wegsamkeit des Intermicellarsystems sekundärer Zellwände. **[On the permeability of the intermicellar system of secondary cell walls.]** *Protoplasma* 33, 1939 (371–8). [G.g.] Repr. P.R.

Ramie fibres enclosed in Canada balsam or colophony, except for one free end, were permeated by water and water-soluble substances applied to that end. Hence it is concluded that intermicellar capillaries of cell walls remain similarly permeable when embedded in resinous matter.

12.14 : 31.1 : 31.3. PRESTON, R. D. **The molecular chain structure of cellulose and its botanical significance.** *Biol. Rev.* 14, 1939 (281–313). [Department of Botany, University of Leeds.]

A full discussion, in comparatively simple language, of the work that has led to current views on the structure of cellulose, including the evidence obtained from organic chemistry, X-ray analysis, and polarization optics. Cellulose is shown to consist of long molecular chains, of which the links are β-glucose residues bound together in the chain by primary valences. The linkage is universally of the 1 : 4 type. The chains themselves are bound

together into ill-defined bundles by secondary valences or van de Waals forces. Incrusting substances such as pectin and lignin are intermicellar, while hemicelluloses, e.g. xylan, are intramicellar. The evidence for the existence of micellar aggregates (fibrils, etc.) is discussed in some detail.

The cellulose chains of the secondary wall form a spiral round the cell, which in some cases retains the same sign and pitch in different layers of the wall, but in others varies from layer to layer. A similar spiral arrangement has also been found in the primary wall of all cases critically examined, thus throwing doubt on various theories of wall growth based on the assumption of a transverse arrangement in the primary wall. Such evidence as there is points to a change during growth of the inclination of the original spiral.

A new layer deposited on a wall may be influenced by existing layers but the fundamental orienting mechanism must lie in the cytoplasm. The evidence pointing to protoplasmic streaming as the mechanism involved is held to be hardly convincing, and it is suggested that the configuration of the protein molecules at the cytoplasm-wall interface may be involved.

12.14 : 12.2. MESSERI, A. Aspetti dei tessuti corticali, radicali ed ipocotilari in giovani plantule di Conifere. [**Aspects of the cortical, radical, and hypocotylar tissues in young Conifer seedlings.**] *Nuovo G. bot. ital.* 46, 1939 (643–5). [It.] L.S.

The transition from the radicle to the hypocotylar zone was marked by a change in the appearance of the parenchyma, especially in the cortex. In the radicle, the cortical cells aged very quickly, as indicated by stopping of cell division, loss of turgescence, suberification, etc., while in the hypocotyl they kept the character and appearance of youth for a long time. This is illustrated by means of microphotographs of Aleppo Pine.

12.14 : 12.11 : 12.2. BURT, L. B. **The bearing of Zalenski's law on conifer leaves.** *Trans. Kans. Acad. Sci.* 42, 1939 (113–21). [Kansas State College, Manhattan.] N.H.M.

Investigations on leaves of *Abies concolor*, *Juniperus virginiana*, *Picea pungens*, *Pinus banksiana*, *P. laricio*, *P. strobus*, *P. sylvestris*, and *Thuja orientalis*, showed that photosynthetic cells decreased in size and increased in frequency from the basal to the apical parts. The stomatal frequency increased in the same direction. This bears out the observations made by Zalenski and others on plants in general.

12.14 : 12.2. BOKE, N. H. **Histogenesis and morphology of the phyllode in certain species of *Acacia*.** *Amer. J. Bot.* 27, 1940 (73–90). [University of California, Berkeley.] O.B.D.

All the evidence gained in this detailed study indicates that the phyllodes of Acacias are homologous with the petiole/rachis of a pinnate foliage leaf, and that the apical pointlet, if not merely a physical apex, can be nothing more than an abortive terminal leaflet. *From author's summary.*

12.19. Geographical Distribution. Plant Geography and Sociology

12.19 : 12.2 (9). TUYAMA, T. **On *Santalum boninense* and the distribution of the species of *Santalum*.** *J. Jap. Bot.* 15, 1939 (697–712). [Jap.e.] K.

The genus *Santalum* is divided into four sections: *Eusantalum*, with 9 species, occurs in Lesser Sunda, New Guinea, Australia, Melanesia, and the Bonin Islands; *Solenantha* sect. nov., with 4 species, and *Hawaiiensia*, with 4 species, are restricted to the Sandwich Islands; *Polynesica*, with 3 species, is scattered in south-eastern Polynesia. *Santalum boninense* is remarkable in that it occurs far northwards of the range of the remaining species of the section *Eusantalum*. *From author's summary.*

12.19 : 01. SANDERSON, I. T. **The use of geometric figures in ecological description.** *Carib. For.* 1 (3), 1940 (15–9). [E.e.span.]

12.19.1. *Regional Floras*

12.19.1 : 01 : 02 (73). **Approved changes in Sudworth's Check List.** U.S.D.A. Forest Service, Washington, D.C. 1940. pp. 98.

An extensive annotated list is given of changes in the English names of trees catalogued in Sudworth's Check List. The revised names have been proposed for standardization by the Forest Service Tree Name Committee and approved by the Acting Chief of the U.S. Forest Service.

12.19.2. *Forest Types and Woodland Communities past and present*

12.19.2 (410). TANSLEY, A. G. **Natural and semi-natural British woodlands.** *Forestry* 14, 1940 (1–21).

Thirty years ago the author expressed the view that the greater part of the existing woodlands of England largely retain their original character. Subsequent study has not materially affected this conclusion, and, apart from plantations of exotics, most British woodlands must be regarded as natural or semi-natural. A historical sketch is given of forest succession in the British Isles from the last glaciation up to the present time, followed by an outline of the composition of existing woodland types. Two climatic formations are recognized:—Deciduous Summer Forest, comprising Oakwood (*Quercetum roboris et sessiliflorae*), Beechwood (*Fagetum sylvaticae*), Calcicolous Ashwood (*Fraxinetum calcicolum*), and Alderwood (*Alnetum glutinosae*); and Northern Coniferous Forest, which includes Pinewood (*Pinetum sylvestris*) and Birchwood (*Betuletum pendulae et pubescentis*). Oakwood and Beechwood are further subdivided into various types characteristically associated with particular edaphic conditions.

12.19.2 : 09.7 (68.9). WILLAN, R. G. M. **Notes on the vegetation of Northern Nyasaland.** *Emp. For. J.* 19, 1940 (48–61).

Floristic notes on various regions in the northern two-thirds of Nyasaland, with a condensed commentary by Dr. J. Burtt Davy. Reference is made to the potential importance of two unidentified species of Bamboo, one of which is carefully cultivated by the Sukwa tribe of the Misuku Hills, and to the native use of *Acacia campylacantha*, *A. woodii*, and *A. albida* as indicators of the more fertile soils.

12.19.2 : 2 : 3 : 12.2 (68.9). MARTIN, J. D. **The *Baikiaea* forests of Northern Rhodesia.** *Emp. For. J.* 19, 1940 (8–18).

Baikiaea plurijuga Harms, known as Rhodesian Teak or Redwood, is the chief sleeper timber of southern Africa and the only timber exported in any quantity from Northern Rhodesia. An outline is given of its geographical distribution and ecology, and of its silviculture, exploitation and utilization in Northern Rhodesia.

12.19.2 : 11.2 (72). MULLER, C. H. **Relations of the vegetation and climatic types in Nuevo Leon, Mexico.** *Amer. Midl. Nat.* 21, 1939 (687–729). [Bureau of Plant Industry, U.S.D.A.] L.S.

12.19.2 : 12.2 : 2 : 6 (729.5). HOLDRIDGE, L. R. **Some notes on the mangrove swamps of Puerto Rico.** *Carib. For.* 1 (4), 1940 (19–29). [E.e.span.]. [Tropical Forest Exp. Sta., Puerto Rico.]

The Mangrove swamps of Puerto Rico total about 16,000 acres, of which about 11,000 acres are administered by the Insular Forest Service. The stands are highly productive and consist largely of White, Black, Red, and Button Mangrove (*Laguncularia racemosa* (L.) Gaertn., *Avicennia nitida* Jacq., *Rhizophora mangle* L., and *Conocarpus erecta* L., respectively). The Red Mangrove is found in the wettest spots or even in the water, the Button Mangrove on the edges of the swamps or on the adjacent high ground, while the Black and White Mangrove occupy the swamp areas in between. Openings occur where the Red Mangrove has been clear-cut, as this species does not sprout readily from the stumps. Openings are also found on areas covered with the fern *Acrostichum aureum* L., and on highly saline areas in the drier parts of Puerto Rico. The first type may be reforested by direct sowing, while burning and clearing of the fern areas followed by planting with natural seedlings of the White Mangrove has given excellent results. The woods, though not very valuable, find a ready market for miscellaneous uses. Based on the local market and labour conditions and on an estimated diameter growth of 2 inches in 5 years, a selection system of cutting with a 25-year rotation and a 5-year cutting cycle is recommended. Diseases and insects present no serious problems, but a strict vigilance is necessary to prevent timber theft.

12.19.2 : 11 (73). **Forest cover types of the eastern United States. Report of the Committee on Forest Types, Society of American Foresters.** Society of American Foresters, Mills Building, Washington, D.C. 3rd ed., 1940. pp. 39.

A total of ninety-seven types is described according to composition, associates, occurrence, place in succession, importance, and variants and synonyms. The tree species mentioned in the type descriptions are listed separately.

12.19.2 (74.4). EGLER, F. E. **Berkshire plateau vegetation, Massachusetts.** *Ecol. Monogr.* 10, 1940 (145–92). [New York State College of Forestry.]

The underlying rocks, the glacial topography, and the various soil series in this region are not correlated with the more important types of vegetation, but biotic factors,

particularly the decrease in grazing and gradual abandonment of pastures in recent times, have determined significant variations in existing vegetation.

The vegetation communities recognized in this paper are those which stand out most clearly in the complex of natural vegetation. Three of Bray's vegetation zones of New York State are found on the Plateau. 'Zone B', characterized by Chestnut, Oaks, Hickories, and Tulip Poplar, and dominantly austral in flora and vegetation, occupies the lower elevations. 'Zone C' with Sugar Maple, Beech, Yellow Birch, Hemlock, and White Pine occurs at intermediate elevations. The old fields are characterized by Grey Birch, White Pine, and about 50 secondary species, and isolated islands of Oak and Hickory are found on some of the exposed summits. The existing regional forest is predominantly Beech and Hemlock, with Sugar Maple and Yellow Birch abundant, also White Ash, Red Oak, Red Maple, Basswood, Black Cherry, and Paper Birch. 'Zone D' with the dominant trees of Zone C, plus Red Spruce, Balsam Fir, and Paper Birch, occurs at highest altitudes. Red Spruce is most abundant in old fields, with less Grey Birch than in Zone C and no White Pine. The regional forest is dominantly Beech and Red Spruce; Red Oak, White Pine, and Basswood are very rare; Sugar Maple, Yellow Birch, Hemlock, Red Maple, White Ash, Black Cherry, Balsam Fir, and Paper Birch are common. *From author's summary.*

12.19.2 (74.7). GORDON, R. B. **The primeval forest types of southwestern New York.** *Bull. N.Y. St. Mus.* No. 321, 1940. pp. 102. Pl. Sci. Lit. 11 (21), (8).

12.19.2 (76.9). BRAUN, E. L. **An ecological transect of Black Mountain, Kentucky.** *Ecol. Monogr.* 10, 1940 (193–241). [University of Cincinnati.]

Data obtained from a study of forest communities in an area representative of Kentucky south-east of Pine Mountain. Most of the forest communities in this area belong to the mixed mesophytic association of the deciduous forest, which is the regional climax and is here represented by a number of distinct association-segregates and transitional communities. The most important associate-segregates are the Beech/Hemlock, Sugar Maple/Basswood/Buckeye, Chestnut/Sugar Maple/Tulip, Beech/Chestnut (with ericaceous layer), and White Oak/Beech. The Sugar Maple/Basswood/Buckeye forest is the best defined of the forest types and is found at elevations above 2,000 ft. on all northerly and northeasterly slopes. On steep southerly and southwesterly slopes, and on some of the ridge crests of the northwesterly slopes is found an Oak/Chestnut forest, a physiographic climax in which Chestnut and Chestnut Oak (*Quercus montana*) comprise nearly 70 per cent. of the canopy. *From author's summary.*

12.2. *Special [Systematic] Botany*

12.2. (59.3–9). MERRILL, E. D. **Records of Indo-Chinese plants, II.** *J. Arnold Arbor.* 21, 1940 (364–91). [Arnold Arboretum, Harvard University.]

Notes on occurrence and nomenclature of miscellaneous species. Several new tree species are described.

12.2 : 31 (63). GIORDANO, G. Nuove piante forestali dell' A.O.I. [**New forest plants of Italian East Africa.**] *Riv. for. ital.* 2, 1940 (250–8). [It.]

Notes on botanical characters and wood structure of the following new species described by Chiovenda:—*Olea mussolinii*, *Manilkara butugi*, *Pouteria* (*Sersalisia*) *ferruginea*, and *Cant*[*h*]*ium giordanii*.

12.2 (95). MERRILL, E. D., and PERRY, L. M. **Plantae Papuanae Archboldianae, III.** *J. Arnold Arbor.* 21, 1940 (292–327). [Arnold Arboretum, Harvard University.]

Includes descriptions of new Papuan tree species in the families Barringtoniaceae and Meliaceae.

12.2 (95). KOBUSKI, C. E. **The Oleaceae of New Guinea collected by L. J. Brass.** *J. Arnold Arbor.* 21, 1940 (328–35). [Arnold Arboretum, Harvard University.]

Notes on species of *Jasminum*, *Ligustrum*, and *Linociera*, including a description of *Linociera brassii* sp. nov.

12.2 : 01. HILL, A. F. **Some nomenclatorial problems in *Acacia*.** *Bot. Mus. Leafl. Harv.* 8 (5), 1940 (93–105). Pl. Sci. Lit. 11 (17), (2).

12.2 : 34.26. CRANE, H. L. **The Tung Tree.** Bureau of Plant Industry, U.S. Department of Agriculture, Washington, D.C. 1939. pp. 9. [Division of Fruit and Vegetable Crops and Diseases.]

12.2 (81). SMITH, A. C. **Notes on the genus *Amburana* Schwacke & Taub. (*Torresea* Fr. Allem.).** *Trop. Woods* No. 62, 1940 (28–31). [New York Botanical Garden.]

Amburana is the correct name of this genus, which has two species occurring in Brazil.

12.2 (72 : 728). JOHNSTON, I. M. **Studies in the Boraginaceae, XV. Notes on some Mexican and Central American species of *Cordia*.** *J. Arnold Arbor.* 21, 1940 (336–55). [Arnold Arboretum, Harvard University.]

Includes a key to the section *Pilicordia* and descriptions of several new species.

12.2 (931). MOORE, L. B. **The structure and life-history of the root parasite *Dactylanthus taylori* Hook. f.** *N.Z. J. Sci. Tech.* 21, Sec. B, 1940 (206–24). [Botany Division, D.S.I.R.] P.R.

A description of the range, habit, habitat, morphology, and life history of *Dactylanthus taylori* Hk.f. (Balanophoraceae). This species, the only one of the genus, is endemic in New Zealand, and lives as a parasite upon tree roots. Its hosts include *Schefflera digitata*, *Panax arboreum*, *Coprosma grandifolia*, *Myrsine urvillei*, *Pittosporum eugenioides*. *P. ellipticum*, *Fagus*, *Hedycarya*, *Geniostoma*, *Pseudopanax crassifolium*, *Nothopanax colensoi*, *Griselinia littoralis*, and probably many other species.

12.2 (69). BURTT DAVY, J. **Note on *Dalbergia retusa* Baill.** *Trop. Woods* No. 62, 1940 (31–2).

According to Viguier, *Dalbergia retusa* Baill. and *D. obtusa* H. Lec. must be dropped in favour of the name *D. toxicaria* Baill., with which they appear to be synonymous.

12.2 (8). DUCKE, A. **Additions to 'Revision of the species of the genus *Elizabetha* Schomb'.** *Trop. Woods* No. 62, 1940 (32–3).

12.2 (8). DUCKE, A. **Notes on the Wallaba trees (*Eperua* Aubl.).** *Trop. Woods* No. 62, 1940 (21–8). [Jardin Botanico de Rio de Janeiro.]

The paper includes a key to the species.

12.2 : 31 (67.2). CHEVALIER, A. Sur un bois du Gabon peu connu : *Eurypetalum batesii* Bak. f. **[On a little known Gabon tree species : *E. batesii*.]** *Rev. Bot. appl.* 20, 1940 (176–9). [F.] P.R.

A hitherto unidentified tree from the forests of Ogooué, Gabon, has proved to be *Eurypetalum batesii* Bak. f., of which a completed description is given from the specimens now available. The author denies Baker's statement that the wood of this species is inferior and claims that it might well replace the woods of *Copaifera*, *Macrolobium*, *Berlinia*, and *Erythrophleum*. The heartwood is described as dark red, very dense (density 1·172), and easy to work. Native names of the tree are: Andzilim (Pahouin), Mbusa (Echira), and Mbosa (Mithogo).

12.2 : 2 : 3 (729.2). SWABEY, C. **Blue Mahoe of Jamaica.** *Carib. For.* 1 (4), 1940 (11–2). [E.span.]

Notes on the range of distribution, habitat in Jamaica, silviculture, timber, and utilization of *Hibiscus elatus* Sw. The tree is of considerable importance in Jamaica and promises to be one of the most valuable species for afforestation purposes owing to its rapid growth and relatively wide range of habitat.

13.1. *General Zoology*

13.1 (4). CARPENTER, J. R. **Insect outbreaks in Europe.** *J. anim. Ecol.* 9, 1940 (108–47).

A review compiled from published records. Though these give insufficient data for determining long-term trends in insect populations, they can be used as a rough guide to periods of abnormal abundance in certain species. At least in the deciduous forest region, outbreaks tend to occur in the same groups of years or at closer intervals than would be expected from chance.

13.1 : 12.2 (66.9). GOLDING, F. D. **Further notes on the food-plants of Nigerian insects. V.** *Bull. ent. Res.* 31, 1940 (127–30).

In 1927, 1931, 1935 and 1937 the writer published four papers on the food plants of Nigerian insects in the *Bull. ent. Res.* (18, pt. 1; 22, pt. 2; 26, pt. 2; and 28, pt. 1). The present paper tabulates some additional data under name of insect, name of food plant, part attacked, month of appearance, and locality and remarks.

13.1 : 13.2. WILKINSON, D. S. **On the identity of *Apanteles praepotens*, Haliday (Hym. Bracon.).** *Bull. ent. Res.* 31, 1940 (141–4). [Imperial Institute of Entomology.]

13.1 : 13.2 : 12.12 : 12.2. BERRY, P. A. **Biology and habits of *Ephialtes turionellae* (L.), a pupal parasite of the European Pine**

shoot moth. [*Rhyacionia buoliana* **Schiff.**] *J. econ. Ent.* 32, 1939 (717–21). R.A.E. A28 (362–3).

13.1 : 13.2 : 12.2 (66–7). HEIM, R. Les champignonnières des termites et les grands champignons d'Afrique tropicale. **[The fungus beds of the termites and the large fungi of tropical Africa.]** *Rev. Bot. appl.* 20, 1940 (121–7). [F.] P.R.

A recent tour in the French colonies of tropical Africa has convinced the author that the fungus beds in termitaria serve merely as hatcheries for the larvae and not for food production, the occurrence of the fungi being an incidental consequence of the material (chewed woody debris) employed in their construction. The large fructifications found on termite heaps arise from the mycelia in the subterranean fungus beds and represent a much greater number of species than has been supposed. Close resemblances between different fungi are due to adaptive convergence in response to the special environment.

13.1 : 13.2 : 4. HAMILTON, W. J., and COOK, D. B. **Small mammals and the forest.** *J. For.* 38, 1940 (468–73). [Cornell University and New York State Conservation Department.]

In the forests of the northeastern States the small mammals, which include rodents such as various mice, the chipmunk and the flying squirrel, and insectivores as the shrews and moles, are an important factor in the control of insect populations. These small mammals often number up to 200 per acre in wooded areas, and, as most of them are active throughout the year, they are particularly effective against destructive forest insects that spend part of their life in or on the soil, such as canker worms, fall web-worms, leaf rollers, leaf beetles, tussock moths, many weevils, cicadas and the Larch, Pine and Spruce sawflies. It is shown that insects make up 20 per cent. or less of a rodent's diet, whereas for insectivores this runs above 50 per cent.

Furthermore, the burrowing of small mammals will improve soil conditions; they serve as food for valuable fur-bearers, and owing to their abundance, they act as a buffer species for predatory birds and mammals. It is pointed out that the effect of logging or other human activity may be detrimental to small mammals and certain practices are suggested for making the habitat more attractive to them.

13.2. *Special* [*Systematic*] *Zoology*

13.2 : 12.12 : 12.2 (79.4–5). HALL, D. G. **Two new species of Tachinidae parasitic upon Hemlock sawfly larvae in North America (Diptera: Tachinidae).** *Proc. ent. Soc. Wash.* 41, 1939 (239–43). R.A.E. A28 (371).

Descriptions of *Tsugaea nox* gen. et sp. n., and *Diplostichus sellersi* sp. n., which are parasites of larvae of *Neodiprion tsugae* Middleton on *Tsuga* in Oregon. *D. sellersi* was also reared from *Neodiprion* sp. in California.

13.2 : 13.1 : 12.12 : 12.2 (52). ISHII, T. **New Chalcidoid and Proctotrypoid wasps reared from forest insects by Dr. H. Kôno.** *Kontyû* 13, 1939 (187–91). R.A.E. A28 (262).

Five new species of parasitic wasps, two of which belong to a new genus that has been named *Roptoceroidea*, are described from *Scolytus* sp., *Ips* spp., and eggs, probably of *Rhynchota*, on *Picea jezoensis* in Hokkaido and Sakhalin.

13.2 : 12.12 : 12.2 (7). CUSHMAN, R. A. **New Ichneumon-flies parasitic on the Hemlock sawfly (*Neodiprion tsugae* Middleton).** *J. Wash. Acad. Sci.* 29, 1939 (391–402). R.A.E. A28 (371).

The new species are *Habrocryptus* (*Ischnus*) *oregonensis*, *Spilocryptus neodiprionis*, *Microcryptus* (*Aptesis*) *tsugae*, and *Lamachus oregon*, which were primary parasites, *Thysiotorus latifrons* and *Panargyrops areolaris*, which were probably secondary, and *Delomerista diprionis*. The last-named was also reared from various other sawflies taken in different regions.

2. SILVICULTURE

2 : 31.7 : 12.2. HEIKINHEIMO, O. Om odling av masurbjörk. **[On the cultivation of Curly Birch.]** *Skogen* 27, 1940 (165–7). [Sw.]

Curly Birch [Cf. *For. Abs.* 2 (53)] comes exclusively from abnormal forms of *Betula verrucosa*. In Finland such trees occur chiefly in Tavastland and west of Lake Ladoga; they are also found in Nyland, but are absent north of Tammerfors. In Sweden they are known to occur in Värmland. Isolated examples have also been reported from Estonia and Latvia.

Curly Birch trees vary widely in stem form, habit of growth, and development of curly figure, and the figured wood may be restricted to portions of the stem and branches. The types most sought after are those that combine, so far as possible, normal straight stem growth and well developed curly figure. As compared with normal trees of *B. verrucosa*, the curly trees show much reduced height growth. The main tending operation is pruning, which is best performed in two stages: (i) the branches are cut to leave a short stub with a few leaves, and (ii) when the stem has put on sufficient increment the stubs are cut flush with it. On the whole the trees are tolerant of pruning, although increment borings may cause severe damage and loss of valuable wood. As a result of the peculiar arrangement of the wood fibres the trees often tend to become unsteady, and propping is then necessary. Though the characteristic figure is apparently heritable, the best method of propagation is considered to be by cuttings or grafts.

2 : 12.2 (728.2). STEVENSON, N. S. **Balsa in British Honduras.** *Carib. For.* 1 (3), 1940 (1–3). [E.span.]

Notes from recent experimental work in British Honduras dealing with technique of regeneration, collection of floss, and separation of seed from floss. All botanical material reported in British Honduras is believed to refer to the one species *Ochroma limonensis* Rowlee. It has been determined that the species is a light demander, requires fairly good soil drainage, and that excellent natural regeneration can be obtained by burning at seeding time or up to 3½ months afterwards. Artificial regeneration should be avoided but where necessary the area should be cleared, the seed broadcast sown, and the land burned.

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21 : 12.2. ***Archytea vahlii.*** *Malay. For.* 9, 1940 (82).

Growth data from one sample plot in the Topah district.

21 : 11.46 : 23.21 : 23.3 : 12.2 (47.6). KRUPENIKOV, I. A. ***Betula kirghisorum*, the Birch of Kirghizia, its soil- and salt-resistance.** *C. R. Acad. Sci. U.R.S.S.* (*n.s.*) 26, 1940 (706–8). [E.] O.R.S.

B. kirghisorum occurs only in the Naurzum forest in the steppe area of Kazakhstan and in the Sypsyn-Agach and Aman-Karagai forests of the Kustanai district. It grows mainly in flat depressions between sand hills on a humous solonchak soil, the upper horizons of which have a light clayey or sandy-clayey texture, while the underlying stratum is a rather coarse sand. Tables are given of the results of soil analyses, which show that the tree is at least as tolerant of high salt concentrations as Tamarisk or Cottonwood, and surpasses both of these species in resistance to SO_4 ions. The high salt resistance of *B. kirghisorum* suggests that it may be a valuable species for the afforestation of alkaline steppe soils without requiring special soil-improvement work.

21.4 : 12.15 : 11.46 : 11.48–9 : 12.2 (52). TAZOYE, H. **Modification and plasticity of the initial root system of some useful coniferous seedlings in Hokkaido by different soils.** *Bull. Sch. Agric. For., Taihoku* No. 1, 1940 (94–112). [Jap.e.]

An account is given of the root development of 4-year-old seedlings of *Abies mayriana*, *Picea jezoensis*, and *P. glehnii*, grown in a wide range of soils. Regardless of species, the root penetration of seedlings was deepest in coniferous humus soil or clay soil, next deepest in the humus/rich loam, deciduous humus, and medium sand soils, and shallowest in the silt and volcanic-ash soils. The ratios of horizontal extent of lateral roots to depth of tap roots were large for all humus soils, smaller for volcanic-ash, silt, peat, or clay soils, and smallest for coarse to fine sand soils. The number of root tips was greater in the humus and peat soils than in the coarse or medium sand soils. There was a marked variation according to soil type in the number of living root tips at different depths. In general, all the species developed the most vigorous root systems in humus/rich loam, coniferous humus soil, deciduous humus soil, and peat soil; development was poorer in fine sand soil, volcanic-ash soil and clay soil, and poorest in coarse or medium sand soils and silt soil. The initial root systems of the 3 species showed adaptability to varied conditions in decreasing order as follows: *A. mayriana*, *P. glehnii*, *P. jezoensis*. As a rule, *A. mayriana* had a long tap root with no prominent laterals, *P. jezoensis* a short tap root with prominent laterals, and *P. glehnii* a long tap root with prominent laterals. The roots of *P. glehnii*, however, were unable to

penetrate so deeply as those of *A. mayriana* or to spread so widely as those of *P. jezoensis*. It appears that *A. mayriana* will grow even in desert regions where the surface soil may become excessively dry, or in humid regions where the soil is coarse, porous, and non-retentive of moisture; *P. jezoensis* only in regions of well distributed rainfall or humid regions with soils fairly moist throughout the year. The ecological characters of *P. glehnii* are not yet clear. *From author's summary.*

21.4 : 12.2 (71.3). BANNAN, M. W. **The root systems of northern Ontario conifers growing in sand.** *Amer. J. Bot.* 27, 1940 (108–14). [Department of Botany, University of Toronto.] O.B.D.

Native conifers growing together on a sand plain in northern Ontario provided an opportunity of studying the root habits of these species. The root systems of both young and old *Larix laricina* and *Picea mariana* growing in sand were found to be shallow in most cases and to resemble the plate-like habit characteristic of trees in swamps, the habitat in which these species often grow. Much greater diversity was observed in the roots of young *Picea glauca*, some being shallow, others deep. The root systems of older trees were variable in form but more uniform in depth, the maximum ranging from 2 to 4½ feet. The roots of young *Abies balsamea* were less variable than White Spruce (*P. glauca*) but the average depth was similar. The deepest root habit was found in *Pinus banksiana*, the roots of both young and old trees usually reaching greater depths than those of other coniferous trees of like age. Jack Pine (*P. banksiana*) was both the most vigorous and the most deeply rooted of the conifers on the plain. On the other hand, a comparison between individual Balsam (*A. balsamea*) and White Spruce failed to reveal a correlation between stem growth and depth of roots. *Author's summary.*

23. FORMATION OF STANDS

23 : 24 : 33.32 : 12.2 : 72. EHRHART, E. O. **What cost to grow pulpwood from planted Spruce?** *J. For.* 38, 1940 (327–9). [Armstrong Forest Company.]

The average acre of 30-year-old Spruce plantations, in north-western Pennsylvania, yielded 10·79 standard cords of peeled pulpwood from a thinning of the largest trees, which removed 60 per cent. of the total basal area. Making allowance for land value, cost of planting, taxes, protection cost, and interest compounded at 3 per cent., it is determined that the stumpage cost of the wood removed was $1·80 per cord. Furthermore, assuming that growth rate of released trees will be up to that of the trees removed, that the cutting of the residual stand will take place in 1959, and that none of the present 1- and 2-inch-class trees will reach maturity, it is estimated that the yield from the average acre in 1959 will be 47 cords, making a total yield of 57·79 cords per acre, and that the average stumpage cost of wood removed from the two operations will be $0·84 per cord.

23.1. *Natural Formation of Stands*

23.1 : 12.2 (54.2). SMYTHIES, E. A. **Sal regeneration *de novo*.** *Indian For.* 66, 1940 (193–9).

A clear definition of the forest type, canopy and silvicultural treatment, to which conclusions given in a previous article [Cf. *For. Abs.* 1 (254)] are applicable. Frequent inspection of the area and short-term planning are suggested as necessary for final success in the establishment of natural Sal regeneration.

23.1 : 12.2 (54). WARREN, W. D. M. **Sal regeneration *de novo*.** *Indian For.* 66, 1940 (334–40).

A recent article by E. A. Smythies [*For. Abs.* 1 (254)] on natural regeneration of Sal in the United Provinces is discussed, and the difficulties encountered in this region are contrasted with conditions in Singhbhum, Bihar, where regeneration is obtained with ease. Annual burning is practised in the U.P., except in a good seed year and the following year, to destroy the leaf layer and to keep down weeds. In Singhbhum the seed germinates adequately in spite of the presence of litter, and burning has long been abandoned as it has proved detrimental to the young growth, which is kept free by repeated cleanings until able to compete with the weeds. A comparison of climatic data for the two regions confirms Smythies's statement that lack of sufficient rainfall at the time of seed fall is the chief adverse factor in the U.P. The present author suggests that it might be possible to modify the climatic factor, and quotes a statement by Visher on the beneficial effect of contour trenching in stimulating plant growth, which in turn alters the climate of the immediate

locality. In conclusion, it is pointed out that there is a sound basis for drastic openings of the canopy as practised in Singhbhum, since root competition from too dense an overwood is known to have produced symptoms of drought in the regeneration.

23.2. *Artificial Formation of Stands. Artificial Regeneration*

23.2 : 56–7 : 12.2 (54.7). DHARESHWAR, S. S. **Honavar Range and Teak regeneration. Pt. II.** *Indian For.* 66, 1940 (345–9).

Yield statistics from a test plot appear to confirm the view expressed in a former article [*For. Abs.* 1 (125)] that 9 ft. × 9 ft. is the best spacing for Teak in the Honavar range. The statistics are tabulated and briefly discussed.

23.21. Choice of Species

23.21 : 12.2. KHARITONOVICH, F. N. **On the most suitable Oak species for forest cultivation in the Steppe.** *Lesnoe Khozyaystvo, Moscow* 1940 (4), (29–34). [R.]

The author stresses the suitability of *Q. pedunculata* Ehrh. var. *praecox* Czern. for shelterbelts and steppe forests in general. His argument is based mainly on growth data from the Mariupol Forest Experiment Station.

23.21 : 33.51 : 57 : 12.2 (410). BOOTH, H. A. **The growing of Sitka Spruce for pitprops.** *Quart. J. For.* 34, 1940 (72–4).

Measurements of two Sitka Spruce stands of about 35 years of age showed 1,150 and 1,100 poles per acre with a volume under bark of 3,929 and 3,817 cu. ft. respectively, corresponding to nearly 50,000 lin. ft. of props per acre. The value per acre would be about £110 at the maximum controlled price. Though less strong than Scots Pine, the props are acceptable to collieries. The two stands in question were underthinned, and it is suggested that deliberate underthinning might be practised to secure a large number of stems per acre, and possibly better quality resulting from closer growth rings, though this latter point needs confirmation by authoritative tests. Sitka Spruce is tolerant of poor soils and should be a desirable tree to grow on a short rotation for pitprops, if the site is within 50 miles of a colliery.

23.22. Tools for Cultural Work

23.22 : 07.7. GEETE, E. Sjöströms skogsharv. **[Sjöström's forest harrow.]** *Skogen* 27, 1940 (170–1). [Sw.]

The harrow has a set of three curved teeth, made of flat spring steel and mounted in a tubular steel frame consisting of shafts and steering handles, which are levered to control the depth of the teeth. The weight of the implement is carried on a pair of spring-steel runners, fixed in front to the middle of the shafts but free at the back. By sliding the teeth sideways it is possible to vary the breadth of the seed patches. The teeth are detachable and one, two, or three may be used at will, thus adapting the harrow to various kinds of soil treatment, including preparation for line sowings. Since the work of controlling the depth of cut is heavy, two men are needed to operate the machine, each man taking alternate shifts at the handles and with the draught horse. The harrow has met with approval from foresters who have used it.

23.23. Sowings

23.23.1. *Seed Procurement, Treatment, and Testing*

23.23.1 : 12.12 : 12.2. SOKOLOV, D. V. **The results of phytopathological testing of tree seeds at the Leningrad Seed Control Station.** *Lesnoe Khozyaystvo, Moscow* 1940 (4), (34–7). [R.r.]

Since 1938 the Leningrad Seed Control Station has included the phytopathological testing of forest tree seed among its activities. In most species the percentage of samples infected with spores of fungi was found to be very high. Infection was caused usually by relatively harmless saprophytes, but parasites belonging to the genera *Fusarium* and *Alternaria* were also frequently found, particularly in the seed of broadleaved species. *Trichothecium roseum* Link. was often found in Pine and Spruce seed. This fungus is known to cause the death of germinating seed but its parasitism requires further study. The article includes a discussion of the technique of phytopathological seed testing.

23.23.1 : 23.26.5. BARTON, L. V. **Some effects of treatment of seeds with growth**

substances on dormancy. *Contr. Boyce Thompson Inst.* 11, 1940 (229–40).

It was found *inter alia* that *Ulmus americana* seed benefited to a small extent by the application of solutions of 35·5, 11·8, or 3·7 mg./l. of potassium-α-naphthalene acetate. This benefit was not sufficient to warrant the use of the growth-substance treatment as a substitute for either low-temperature pretreatment or soaking in water under a light source as a means of speeding up germination.

23.23.1 : 12.2. ELIASON, E. J., and HEIT, C. E. **The results of laboratory tests as applied to large scale extraction of Red Pine seed.** *J. For.* 38, 1940 (426–9). [New York State Conservation Department.]

Seed tests carried out concurrently with extraction of Red Pine seed resulted in the following information: (1) Considerably more Red Pine seed can be extracted from cones with a kiln temperature of 130°–140° F. for 72 hours than at the original schedule of 120° F. for 48 hours, and that temperatures considerably above 140° F. can be used without injury to the seed. (2) Seed that has been damped in the process of cleaning requires eight hours in the kiln to reduce the seed moisture content to 4 or 5 per cent. (3) A seed injury, which resulted in reduced germination in sand, was found to be caused by the dewinging apparatus and this was corrected by reducing the speed of the shaft from 120 r.p.m. to 60 r.p.m. (4) Germination tests in the sand-bench were found to be more useful than germinator tests in indicating the real ability of the seed to germinate and develop in the soil. (5) Injury to seed as a result of too high humidity in the drying kiln was corrected by increasing the size of the opening in the kiln, thus reducing the relative humidity while the temperature was kept fairly constant.

23.23.1 : 12.2. RIETZ, R. C., and KIMBALL, K. E. **Kiln schedule for extracting Red Pine seed from fresh and stored cones.** *J. For.* 38, 1940 (430–4). [Forest Products Laboratory, Madison, Wisconsin.]

When the seed from freshly collected Red Pine cones is not required for immediate use the cones should be stored on wire-mesh trays or shelves in a well ventilated shed until cone moisture is reduced to about 25 per cent. Good seed yields can then be obtained in five hours, drying the cones at 170° F. and 3 per cent. wood-equilibrium-moisture-content condition (21 per cent. relative humidity), using a forced-air-circulation cone drier. The recommended schedule for drying green cones for immediate use is a temperature of 150° F. and a 3 per cent. wood-equilibrium-moisture-content condition (18 per cent. relative humidity) for a period of nine hours. When it is necessary to store Red Pine cones in gunny sacks, aeration of cones should be improved by stripping back the sacking. Storage of cones in sacks for a period of 4 months may necessitate the use of a temperature as low as 130° F. in seed extraction.

23.23.1 : 12.2. NELSON, M. L. **Successful storage of Southern Pine seed for seven years.** *J. For.* 38, 1940 (443–4). [Southern Forest Exp. Sta.]

The storage of seed of Longleaf, Slash, Loblolly and Shortleaf Pine in screwtop (semi-sealed) glass jars at 35–38° F. for seven years did not reduce the viability of any of the seed, whereas storage at room temperature resulted in almost completely non-viable seed in 4 years or less. Stratification in wet peat moss at low temperatures for 40 days accelerated germination of stored seed of Loblolly and Shortleaf Pine, was deleterious to stored Longleaf Pine seed, and appeared to be unnecessary for Slash Pine seed.

23.23.3. *Methods of Sowing*

23.23.3 : 45.1. SCHOPMEYER, C. S. **Second-year results of direct-seeding experiments in the Western White Pine type using screens for rodent control.** *Res. Note Nth. Rocky Mt. For. & Range Exp. Sta.* No. 6, 1940. pp. 7.

These data confirm the first-year results that were reported previously [Cf. *For. Abs.* 1 (257)]. At the end of the second growing season average stocking of all species in screened spots was 17 per cent. greater from fall sowing than from spring sowing. Screened spots of Western White Pine and Ponderosa Pine maintained their overwhelming superiority over unprotected spots after the removal of the screens at the end of the first growing season. Stocking of the small-seeded Engelmann Spruce at the end of the second year was satisfactory for all sowing methods, as it ranged from 65 per cent. for spring-sown unscreened spots to 91 per cent. for fall-sown screened spots.

23.24. Formation of Crops (Stands) by Planting

23.24.2-3. *Methods of Planting. Spacing*

23.24.2–3 (77.4). RUDOLF, P. O. **Further comments on 'Why forest plantations fail'.** *J. For.* 38, 1940 (442–3). [Lake States Forest Exp. Sta.]

It is maintained that the slit method of planting, which results in the root system being cramped into a single plane, has contributed to tree mortality in plantations of lower Michigan and elsewhere, and that while this method may result in a relatively cheaper initial cost of plantation this does not necessarily mean a cheap final cost. Furthermore root-depth development is not considered as important as lateral development in soils with nutrients and moisture concentrated in the top ½–2 ft. The study under discussion was intentionally made during a severe drought year [Cf. *For. Abs.* 1 (162, 259)].

23.24.2–3 : 23.26.3 : 07.7 (729.7). CATER, J. C. **The use of the conical spade.** *Carib. For.* 1 (4), 1940 (17–8). [E.span.]

Description of a transplanting spade used in Trinidad mainly for lifting 1-year *Calophyllum* seedlings with balls of earth round their roots.

23.26. Plant Rearing. Nursery Practice

23.26. DELEVOY, G. Quelques essais en pépinières. **[Some nursery experiments.]** *Bull. Soc. for. Belg.* 47, 1940 (145–61). [F.]

Various minor experiments are reported from Groenendael, mainly on the development of *Quercus* transplants and of *Quercus* seedlings of different seed origin. In the course of this work it was found that the use of Yedlinsky's biometric curves greatly facilitated the interpretation of height growth data.

23.26. STANKEVICH, V. E. **The determination of the 'net useful area' of nurseries from the 'nutritional area' of seedlings.** *Lesnoe Khozyaystvo, Moscow* 1940 (4), (17–25). [R.]

In sowing Pine seed by machine on sandy podsolized soils near Mogilev, the author found that optimum development of seedlings was obtained with rows 4 cm. wide and 15 cm. apart, and 22–155 seeds sown per metre of row. Within that range the horizontal spread of side roots of the best-developed seedling, at the end of the first vegetation period, equalled 6 cm. Thus the 'absolutely useful area' of the nursery, in sq. cm., was equal to $[4 + (2 \times 6)] \times 1$, where $1 =$ the total length of the rows in cm.

23.26 : 23.24.1 : 21.6. CHISTYAKOV, A. R. **On the vigour of seedlings in plantations in relation to irrigation in nurseries.** *Lesnoe Khozyaystvo, Moscow* 1940 (4), (25–7). [R.]

Report on investigations in the open chernozem steppe of the Chkalov region, Volga provinces, with one-year seedlings of *Fraxinus americana* and *Pyrus malus* produced with and without irrigation. The heavier planting stock from the irrigated nursery showed considerably higher survival in the first vegetation period and produced plants taller than the controls.

23.26.1. *Description of Different Nursery Methods*

23.26.1 : 07.7. STORY, H. D. **Nursery bed shaper.** *J. For.* 38, 1940 (515–7). [Georgia Division of Forestry.]

Details as to material required and method of construction of a nursery bed shaper, which 'lays off and constructs smooth, level beds of uniform width and height (5$3\frac{1}{2}$ in. wide and 4 in. high) with flat walkways 14 in. wide between beds'. It is drawn by an Oliver 80 tractor.

23.26.1 : 23.23.1 : 07.7. STEAVENSON, H. A. **The hammer mill as an important nursery implement.** *J. For.* 38, 1940 (356–61). [Soil Conservation Service.]

The hammer mill is an efficient implement for cleaning hardwood seeds of fleshy-fruited and dry-fruited species, for pulverizing peat and compost, and, with certain adjustments, for scarifying seed. Specifications are given for the type of hammer mill used for these operations, and the technique employed for each type of work is detailed. In cleaning the seed of fleshy fruits, a screen is used with openings slightly smaller than the seed, the hammer shaft is revolved slowly (400–800 r.p.m.), and one or two heavy streams of water flush the pulp through the screen. For dry-fruited species the screen selected is slightly larger than the seed and care must be taken to keep the hammer shaft revolving at low speed so as not to break the seed.

23.26.2. *Rearing of Individual Species*

23.26.2 : 23.23.1 : 12.2. HUBERMAN, M. A. **Studies in raising Southern Pine nursery seedlings.** *J. For.* 38, 1940 (341–5). [U.S. Forest Service.]

A low production figure of plantable trees of Longleaf, Slash and Shortleaf Pines in southern Pine nurseries was found to be due mainly to the pre-sowing treatment of seed, during extraction and storage, rather than to nursery and cultural treatment. However, these investigations indicate other factors that influence to some extent the number of plantable trees produced. The yield of Longleaf and Shortleaf Pines drops significantly when sowing is done after the middle of April, and for Slash Pine after the third week in April. Loss following germination was most commonly the result of failure to root, often due to disturbance of the radicle by wind or movement of burlap cover. Density of seedlings was found to affect the plantable percentage, densities of 30 to 50 per sq. ft. being most favourable for Longleaf Pine, and of 36 to 60 for Slash and Shortleaf Pine.

23.26.5. *Treatment with Growth Substances*

23.26.5 : 21.5 : 07. HANLEY, J. H. **Growth-regulating substances in forest research and practice.** *Univ. Wash. For. Cl. Quart.* 13 (2), 1939–40 (5–9). [University of Washington.]

Possible future uses and the limitations of Vitamin B in forestry research and nursery practice.

23.26.5 : 07.7. DEMORTIER, G. Appareil permettant de déterminer approximativement la quantité d'hormones pénétrant dans les boutures. [**Apparatus for determining approximately the quantity of hormones penetrating into cuttings.**] *Bull. Inst. agron. Gembloux* 8, 1939 (43–51). [F.] Biol. Abs. 14 (9351).

23.26.5 : 21.5 : 12.11 : 12.2. RAPPAPORT, J. De invloed van bladeren en groeistoffen op de beworteling van stekken. [**The influence of leaves and growth substances upon the rooting of cuttings.**] *Natuurwet. Tijdschr.* 21, 1939 (356–9). [Flem.e.] [Physiology Department, Botanical Institute, Ghent.] L. S.

From experiments with *Skimmia foremanii* Mast., in which equal quantities of hetero-auxin were applied to cuttings bearing a number of leaves varying from 0 to 6, it is concluded that the favourable effect of a large number of leaves upon the rooting response of cuttings may be ascribed chiefly to the formation by the leaves of a hypothetical substance, rhizocaline. The suction power developed by the leaves also had a minor favourable influence upon rooting, and work hitherto unpublished has shown that treatment in a dry atmosphere gives better results than in a moist one. *From author's summary.*

23.26.5 : 21.5 : 12.11. ZIMMERMAN, P. W., and HITCHCOCK, A. E. **Adventitious shoots and roots induced by natural influences and synthetic growth substances.** *Contr. Boyce Thompson Inst.* 11, 1940 (127–41).

Disbudded cuttings of *Hibiscus syriacus*, in contrast to those with the buds intact, formed numerous adventitious shoots. Normal polarity was undisturbed, shoots being produced from the upper and roots from the lower portion of the cuttings, with a relatively narrow transition zone between. Root cuttings showed even stronger polarity by producing many shoots from the upper cut end, a few near the edge of the cut, and roots only at the lower end. The new organs were usually associated with proliferating lenticel tissue or the callus formed on scars, and the results suggested that potential meristematic tissue was activated and then regulated by a chemical influence.

When treated with vapours of the naphthalene and indole root-inducing substances, disbudded cuttings of the same species lost their polarity, so that shoot rudiments failed to appear and roots were induced over the whole length of the cuttings. The polarity effect was apparently also suppressed when the bark and wood were separated and kept in the moist chamber; under such conditions both produced callus from which shoots, but no roots arose. Bark extracts were found to contain both growth-promoting and growth-inhibiting substances, while extracts from the wood alone induced leaf epinasty and root formation in tomato plant tissue.

Cuttings of *H. syriacus*, exposed for a few days to high CO_2 concentrations or traces of ethylene gas, and then stored in the moist chamber, produced more adventitious buds than the controls, presumably due to interference with normal metabolism.

In contrast to *H. syriacus*, disbudded cuttings

of *Populus* and *Elaeagnus* formed shoots only at the apical cut surface or at scars where the buds had been removed. Root cuttings of *Paulownia tomentosa* produced shoots from the upper end, but not from the cut surface itself.

23.26.5 : 21.5 : 12.11. HITCHCOCK, A. E., and ZIMMERMAN, P. W. **Effects obtained with mixtures of root-inducing and other substances.** *Contr. Boyce Thompson Inst.* 11, 1940 (143–60).

The root-inducing activity of two or more substances in mixture was found in many but not all cases to be greater than that of the same substances applied individually. This effect was greater than one of simple addition and was manifested in an increase in the number of roots, a higher percentage of rooted cuttings, more uniform rooting, and other effects typical of a higher concentration of a root-inducing substance. Such effects were obtained with substances of different root-inducing activity, but not with those of about equal activity. Cuttings of different genera and species did not respond equally well to a given mixture. Certain mixtures of indole-butyric and α-naphthalene-acetic acids were effective on both indole-butyric- and α-naphthalene-acetic-sensitive cuttings.

Depending on the kind of cutting and the test conditions, the following functioned as activators:—indole-acetic, indole-butyric, α-naphthalene-acetic, and phenyl-acetic acids; vitamins B_1 and B_6; and ethylene. Only a few of the many possible combinations of substances, proportions, and total concentrations, were tried. A mixture of equal parts of two substances (e.g. indole-butyric and α-naphthalene-acetic acids) proved as effective or more so than three- or four-substance mixtures.

Vitamins B_1 and B_6 functioned as activators for root formation in cuttings and not as root growth factors. Parallel tests with established plants also failed to show any favourable effects of B_1 as a root growth factor when added weekly to the soil in concentrations of 0·01 to 10 p.p.m. Deferred treatments of B_1 were not effective on cuttings of various plants, whether or not the cuttings had been given an initial treatment with a root-inducing substance. It is concluded that before any general practical use of B_1 can be recommended for a soil amendment, more substantial data are needed than those hitherto published. *From authors' summary.*

23.26.5 : 21.5. KIRKPATRICK, H. **Effect of indole-butyric acid on the rooting response of evergreens.** *Prof. Pap. Boyce Thompson Inst.* 1 (30), 1940 (273–80). [*Repr.* from *American Nurseryman* 71 (8), 1940 (9–12).]

An article prepared from information compiled at the Boyce Thompson Institute dealing with conifers, Rhododendrons (including some deciduous species), Hollies and a number of other evergreens.

23.26.5 : 21.5 : 12.2. SEN, P. K. **A note on the effect of indole-butyric and indole-acetic acids on rooting of green-wood cuttings with special reference to Litchi and Mango.** *Curr. Sci.* 8, 1939 (553–4). [Fruit Research Station, Sabour, Bihar.] L.S.

Indole-butyric acid definitely stimulated rooting in cuttings of Litchi and *Justicia gendarusa*, and was more effective than indole-acetic acid. In all cases maximum rooting was obtained with the highest concentration [not given] applied for the longest period (48 hours). Actual rooting of Litchi cuttings was obtained only under the treatment of 60 mg. of indole-butyric acid per l. of tap water applied for a 48-hour period. Mango cuttings had not rooted at the end of the test (60 days) but the effect of the chemicals was evident in callus growth.

23.26.5 : 21.5 : 12.2. GRACE, N. H., and THISTLE, M. W. **Vegetative propagation of conifers. V. The effect of indolylacetic acid and nutrient solutions on the rooting of Norway Spruce cuttings.** *Canad. J. Res.* 18, Sec. C, 1940 (122–8). [National Research Laboratories, Ottawa.] P.R.

Norway Spruce cuttings collected in November 1938 were treated, in three experiments, with a series of solutions containing from 1/729 to 400 p.p.m. of indolyl-acetic acid. The effects, in all concentrations, were reduced rooting and increased mortality. The addition of nutrient salts to the treating solution further reduced rooting and increased mortality of the cuttings. These negative results of solution treatments contrast with beneficial effects already reported for application of indolyl-acetic acid in talc dust. [Cf. *For. Abs.* 2 (40).] *Authors' summary.*

23.26.5 : 21.5 : 12.2. GRIFFITH, B. G. **Effect of indole-butyric acid, indole-acetic acid, and alpha naphthalene-acetic acid on**

rooting of cuttings of Douglas Fir and Sitka Spruce. *J. For.* 38, 1940 (496–501). [University of British Columbia.]

Results from this study indicate that (1) dormant cuttings of Douglas Fir and Sitka Spruce can be successfully rooted to the extent of 80 and 100 per cent. respectively by treating with either indole-acetic or indole-butyric acid; (2) indole-butyric acid was more effective for stimulating root development than either indole-acetic or α-naphthalene-acetic acid; (3) the most effective dosage for Sitka Spruce was 25·0 p.p.m. and for Douglas Fir 50·0 p.p.m. for 24-hour treatment periods; (4) treatment during the period 20th February to 30th March gave best results for both species in percentage of rootings obtained and in the time necessary for roots to appear. *From author's summary.*

23.26.7. *Damage in Nurseries and Methods of Protection*

23.26.7 : 12.12 : 12.2 (45). BONGINI, V. Note fitopatologiche. **[Phytopathological notes.]** *Boll. Lab. sper. R. Oss. Fitopat., Torino* 16, 1939 [issued 1940] (54–64). [It.] R.A.M. 19 (443–4).

A fatal wilt of young rooted cuttings of *Cryptomeria japonica* var. *elegans* and *C. viridis*, associated with *Cladosporium laricis* and a species of *Phomopsis*, continued to cause losses in cuttings from apparently healthy mother plants promptly removed from the affected nurseries to a distance of several hundred metres. The spread of infection by apparently healthy cuttings is accounted for by the very slow progress of the disease. Spraying failed to give satisfactory control, and the only measure found to check the condition was to grow the mother plants in a mixed nursery between rows of broadleaved species. It is suspected that *C. laricis* is the pathogen rather than the *Phomopsis*.

During the spring of 1939, Planes (*Platanus*) were severely attacked by *Gnomonia veneta*. Cultural studies with conidia of the imperfect stage (*Gloeosporium nervisequum*) from the leaves, and spores of *Discula platani* and *Fusicoccum veronense* from the branches showed that all belonged to the first-named, with which *G. platani*, *G. valsoideum*, *Sporonema platani*, and *Cytosporella platani* are regarded as identical. The branch-inhabiting form of the disease is regarded as much the more dangerous. The most important control measure is the prompt removal of the first branches that become infected, especially in the nursery; if infection is more advanced, all the large branches should be cut off and burned and the wounds disinfected.

23.26.7 : 12.12 : 12.2. HEIM, R. Un Agaric rhizomorphique parasite des semis de Quinquina en Haute-Guinée. **[A rhizomorphic Agaric parasitic on *Cinchona* seedlings in Upper Guinea.]** *Rev. Bot. appl.* 20, 1940 (77–87). [F.] R.A.M. 19 (431–2).

Seedlings of *Cinchona succirubra* and *C. ledgeriana* growing in frames at Macente, Upper Guinea, were affected by a form of damping-off which attacked them when the two first leaves were 4–5 mm. long. The condition was due to a very small Agaric, possibly a *Clitocybe*, which sent out numerous whitish rhizomorphs that spread through the beds, the mycelium penetrating the deeper tissues of the host. Recommended control measures are:—removal and destruction of the fungi and rhizomorphs as they appear; aeration of the plants in the shade for one or two hours on sunny days, and exposure to the sun for a suitable period; and partial sterilization of the soil before planting, with chemicals, natural heat, or steam.

23.26.7 : 12.12 : 12.2. JACKSON, L. W. R. **Effects of H-ion and Al-ion concentrations on damping-off of conifers and certain causative fungi.** *Phytopathology* 30, 1940 (563–79). [Bureau of Plant Industry, U.S.D.A.]

The amount of damping-off of Ponderosa Pine and Douglas Fir grown in liquid cultures, caused by *Pythium* and *Rhizoctonia* isolates, was lowest at pH 2·5 and 3·5, increased to maxima at 6·5, or less often 5·5, and then decreased at 6·5 or 7·5. Concentrations of aluminium sulphate showed little effect on damping-off in sand cultures at pH 3·5, and no effect at pH 6·5. These results suggest that the value of aluminium sulphate in the control of damping-off is due mainly to its low pH and not to aluminium as such.

23.26.7 : 12.12 : 12.2 (43.1–5). LIEBSTER, G. Baumschulverluste durch den Kiefernnadelblasenrost. **[Nursery losses from Pine-needle blister rust.]** *Blumen- u. PflBau ver. Gartenwelt* 43, 1939 (556–7). [G.] R.A.M. 19 (375).

Pine-needle blister rust, caused by *Coleosporium* spp., recurred after a long interval in a German forest nursery in 1939. Trees of *Pinus sylvestris*, *P. montana*, and *P. nigra* var. *austriaca* are most severely attacked between 3 and 10 years of age, though all ages up to 30 may be infected. The most important control measure is the eradication of the alternate host species, which include common weeds in the genera *Senecio*, *Sonchus*, *Inula*, *Tussilago*, *Petasites*, *Adenostyles*, *Campanula*, *Melampyrum*, *Euphrasia*, and *Alectorolophus*.

23.26.9. *Other Methods of Manuring or Fertilizing*

23.26.9 : 21.3 : 11.47. Němec, A. Untersuchungen über den Einfluss der Stickstoffdüngung auf das Wachstum der Fichte in Waldbaumschulen. **[Research on the influence of nitrogen fertilizing upon the growth of Spruce in forest nurseries.]** *Bodenk. PflErnähr.* 16, 1939 (98–112). [G.g.] [Institut für forstliche Biochemie und Pedologie der staatlichen forstlichen Forschungsanstalten in Praha-Dejvice.] H.S.B.

The effects of unbalanced nitrogen manuring, using $NaNO_3$, $Ca(NO_3)_2$, and $(NH_4)SO_4$, on the growth and mortality of one-year transplants were investigated on a number of sites. The effect on growth did not depend directly on the nitrogen content of the soil, but was determined largely by the degree of acidity and the nutrient supply. Considerable increase in growth was obtained on very acid soils having a favourable phosphorus content. Mortality was not increased as a result of manuring if $NaNO_3$ was applied at least 3 weeks before transplanting, and if the other two fertilizers were applied at least 10 days before or 3–7 weeks after transplanting. In general, $NaNO_3$ and $Ca(NO_3)_2$ gave better survival in very acid, and $(NH_4)SO_4$ in slightly acid to neutral soils.

23.26.9 : 11.42 : 11.47. Wilde, S. A., and Kopitke, J. C. **Base exchange properties of nursery soils and the application of potash fertilizers.** *J. For.* 38, 1940 (330–2). [University of Wisconsin.]

Practically all available potash in the soil is in the form of an exchangeable ion and so the quantity of unleached potash is directly dependent on the base exchange capacity of the soil. From a large number of determinations the following correlations were found to exist:

Exchange capacity of nursery soil	*Average level of available potash retained against leaching*	*Suggested rate of application of potassium chloride or potassium sulphate fertilizer*
m.e./100 g.	*pounds/acre*	*pounds/acre*
3 or less	75	100
3–5	125	150
5–7	200	250
7–9	250	300
9 or higher	275	350

Catch crops, composts and liquid fertilizers are used to increase the potash content of nursery soils having a low base exchange capacity, and soil exchange capacity may often be increased by applications of peat or similar materials.

23.3. *Afforestation*

23.3 : 12.2 (44). Bauby, P. L'utilisation du cyprès chauve dans le midi de la France. **[The use of Bald Cypress [for afforestation] in the south of France.]** *Rev. Eaux For.* 78, 1940 (157–70). [F.f.]

The tree is well adapted to swampy and wet soils in the whole of southern France. It produces valuable timber rapidly, and serves in the drainage of swamps and the fixation of river banks. The usual planting and tending technique is described.

23.3 (54.5). Chopra, R. S. **Afforestation experiments in the Kalachitta Hills.** *Punjab For. Rec.* 1 (7), 1940. pp. 12 + v.

Report on investigations during 1934–9. The area is typical for the conditions prevailing in the extreme north-west of the Province. It presents a combination of factors adverse to afforestation, viz. friable rock, shallow and unstable soil, erratic rainfall, extremes of climate, and prevalence of widespread sheet-erosion owing to deterioration of the natural plant cover through browsing and lopping. The steep hill slopes are particularly devoid of mineral soil and cannot be afforested until a reasonable soil depth is built up under a régime of contour trenching combined with planting of *Agave* and *Opuntia* species. The gentle slopes and the valleys offer some scope for planting and the species *Prosopis juliflora* (arid form) has been found most suitable. The paper includes an appendix in which experi-

mental results with hardwoods, succulents and grasses are listed by species.

23.3 (61). CARULLO, F. I rimboschimenti della Tripolitania. Un caso speciale di aridocultura. **[Reforestation schemes in Tripolitania. A special case of cultivation under arid conditions.]** *Riv. for. ital.* 2, 1940 (168–76). [It.]

Includes a report on a cultivation and irrigation experiment in a 6 × 6 m. Eucalypt plantation in the steppe. It was found that the cultivation of the entire plot, in strips 3–4 m. wide and 15–20 cm. deep, each autumn and spring during the first two years following planting, and very frequent irrigation during the first two summers, produced trees taller and thicker at the age of 4 years than did less frequent cultivation and irrigation.

23.4. *Formation of Forest by Natural Succession*

23.4 : 12.19.2 : 12.2 (75.5–7). MCQUILKIN, W. E. **The natural establishment of Pine in abandoned fields in the Piedmont Plateau region.** *Ecology* 21, 1940 (135–47). [Appalachian Forest Exp. Sta.]

The presence of an adequate seed source is the most important factor affecting the establishment of Loblolly and Shortleaf Pine in abandoned fields in this region. An adequate seed source is defined as a stand of Pine 40 years or more old and 50 per cent. to fully stocked, in which the individual trees, or at least those at the edge of the stand near the field, are characterized by vigorous growth, well developed crowns, and abundant cone production. The parent stand should extend along at least one entire side of the field. In general, site factors do not control the establishment of Pine on abandoned land.

With adequate seed sources and fair to good site conditions in the fields, Pine reproduction in densities equivalent to 1,000 or more seedlings per acre is found up to distances averaging about 330 ft. from the parent stand, densities of 500 or more seedlings per acre up to 460 ft. and beyond that distance seedling establishment is usually erratic and uncertain. Pine may invade fields immediately after abandonment or at any time thereafter when seed is supplied and weather conditions are favourable, probably within 3 to 5 years. *From author's summary.*

24. TENDING OF STANDS AND TREES

24.2. *Thinnings*

24.21 : 12.2. **Tree-poisoning with sodium arsenite.** *Plant. Bull. Rubb. Res. Inst. Malaya* 11, 1940 (5–6).

Stump poisoning with sodium arsenite is safe in Rubber plantations if the whole stand has been cleared for replanting, but stumps of trees felled during thinnings should on no account be poisoned, as root grafting is frequent and the poison finds its way into neighbouring trees. Thinning by frill girdling and poisoning is not dangerous if applied only to trees that bear healthy mature foliage and have a sap stream active enough to draw the poison upwards through the trunk. Poison injected into a leafless or unhealthy tree may be drawn through grafted roots into the sap stream of more active neighbours.

24.25 : 24.36 (489). SCHANTZ-HANSEN, T. **Intermediate cuttings in Danish forests.** *J. For.* 38, 1940 (367–9). [University of Minnesota.]

A review and summary of the discussion on thinnings in *Dansk Skovforen. Tidsskr.* 1938.

24.3. *Opening of the Canopy. Release and Improvement Cuttings*

24.3 : 21.6 : 65–6 : 12.2. PEARSON, G. A. **Growth and mortality of Ponderosa Pine in relation to size of trees and method of cutting.** *J. For.* 38, 1940 (323–7). [Southwestern Forest & Range Exp. Sta.]

An experimental cutting was made in Ponderosa Pine in 1913, using three methods of cutting, with the object of determining the reaction of the residual stands in yield and natural reproduction. The cutting methods used were group selection, light selection, and scattered seed tree, leaving residual stands of 2,846, 4,510 and 1,873 bd. ft. per acre respectively.

Natural reproduction was found to be more dependent on subsequent protection than on method of cutting. Both rate of growth and mortality were highest for the scattered seed tree method, while the light selection cutting showed the highest net increment per acre. Increment and mortality curves, when plotted on the same scale, cross each other near the 30-inch class for all residual stands, indicating

that on the average trees above this diameter contribute nothing to the increment.

24.36 : 56 : 55 : 12.2. KRAUCH, H. **The influence of release on diameter growth of Ponderosa Pine as related to age and vigor.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 84, 1940. pp. 3.

Measurements of the diameter growth of trees of different age and vigour classes, at Kaibab, Arizona, showed that mature and over-mature trees received more benefit from release than did the younger age classes.

24.4. *Shelterbelts. Windbreaks*

24.4 : 23.21 (946). PAYNE, H., and UNWIN, P. T. **Shelter planting for the farm.** *Tasm. J. Agric.* 11, 1940 (18–22). S. & F. 3 (189).

Establishment and choice of species for various Tasmanian conditions of soil and site.

24.4 : 96 (73). DAHL, J. **Progress and development of the Prairie States Forestry Project.** *J. For.* 38, 1940 (301–6). [Prairie States Forestry Project, U.S. Forest Service.]

A general discussion of the problems, objectives, administration and present success of the farm forestry tree-planting project, which was begun in 1935 in the Great Plains of the United States. Average survival for all states since 1935 has been 61 per cent. and the major causes of the 39 per cent. loss have been (1) faulty cultivation 8 per cent., (2) insect damage, mainly grasshoppers, 14 per cent., (3) rodent damage 2·5 per cent., (4) use of small stock 5 per cent., (5) faulty planting and handling of stock 4·5 per cent., and (6) livestock, poor soil, hail and soil erosion 5 per cent.

The present standard basic shelterbelt consists of 10 rows of trees spaced 8 to 10 ft. with the trees spaced 6 to 8 ft. and shrubs 3 to 4 ft. apart. Proper and adequate cultivation has been found to be the most important single operation, following planting, for successful tree establishment in the Plains region. A total of 10,953 miles of shelterbelts had been established to the end of 1939.

24.5. *Pruning*

24.5 : 23.1 : 12.2. NEUNHOEFFER, H. Aufastung von Tannenvorwüchsen. [**Pruning advance growth of Silver Fir.**] *Forstarchiv* 15, 1939 (339–43). [G.]. [Institut für Forsteinrichtung und forstliche Betriebswirtschaft der Universität Freiburg i. Br.] L.S.

The biggest Silver Fir stems in mixed stands are frequently obtained from advance growth. Stem-analysis data and financial estimates show (1) that such stems can produce good timber if pruned at an early age; (2) that such pruning is very profitable; and (3) that no danger need be anticipated from live-pruning Silver Fir flush with the stem, using a sharp saw.

24.5 : 07.7 : 12.2. MEYER, W. H. **Pruning natural Pine stands.** *J. For.* 38, 1940 (413–4). [Brown Mills, N.J.]

In a mixed Pine and hardwood stand of approximately 550 trees per acre, mainly 3 to 9 in. d.b.h., some 225 White and Red Pine (3 to 6 in. d.b.h.) per acre had an average length of 14·7 bole ft. pruned at a cost of ·14 cents per bole-foot or 2·1 cents per tree. Wages paid were 25 cents per hour. The pole saw was found to be the most efficient and versatile tool for this work; either a light, 14-in. blade with 7 points per inch on a 7-ft. pole for the first 12 ft. of bole, or, for higher work, an 18-in. blade with 5 points per inch on a 14-ft. pole.

24.5 : 12.11 : 12.2. ADAMS, W. R., and SCHNELLER, M. R. **Some physiological responses to close pruning of Northern White Pine.** *Bull. Vt. agric. Exp. Sta.* No. 444, 1939. pp. 26.

Ninety-eight per cent. of the live branches that were pruned by saw through the branch base formed callus at the end of the first growing season following pruning, whereas live branches that were saw-pruned without injury to the branch base or that were removed with point-cut pruners showed less than 25 per cent. callus formation. It was also found advantageous to prune through the branch base of recently dead branches, but less so in old dead branches. A detailed study was made of the composition of the callus.

24.5 : 12.12 : 12.2 : 13.2. RECKE, GRAF. Zu 'Neues Verfahren zur Erziehung astreinen Kiefernholzes'. [**On 'A new method of raising knotless Pine timber'.**] *Forstarchiv* 15, 1939 (330). [G.] L.S.

A 'bud-pruning' experiment on the lines described by Buchholz [*For. Abs.* 1 (167–8)] was begun in 1935 on an area of ·5 ha. in Straupitz, but had to be given up owing to severe damage by the Pine shoot moth.

3 : 07 (66.9). MACKAY, J. H. **Forest utilization research in Nigeria.** *Emp. For. J.* 19, 1940 (34–42).

Selective felling of the few commercial species has gone on in Nigeria for the past 50 years, and the resources of large-sized Mahogany and Obeche are diminishing. Intensive exploitation by a forest sawmill industry is envisaged, and research is in progress on the value of the many timbers that occur, their possible uses, and methods of logging, seasoning and preservation. The range of investigations is described, with some details of the methods employed and of simple machines devised for carrying out a preliminary survey of the strength properties of Nigerian timbers. Investigations of minor forest produce are also briefly reviewed. *From author's summary.*

31. PROPERTIES AND ANATOMY OF WOOD

31 : 33. **Substitutes for softwoods.** *Nat Build., Lond.* 19, 1939–40 (178–80). L.S.

A brief note on the possibilities of various timbers that might be used to replace Baltic softwoods in the building trade. The strength properties of 10 Empire and home-grown hardwoods, and of Douglas Fir, are tabulated for comparison with those of Baltic Redwood (*Pinus sylvestris*). A second table gives the working stresses for Douglas Fir or Long-leaved Pitch Pine as permitted under L.C.C. timber by-laws, and a third shows the controlled prices for various timbers.

31 : 33 (88). AINSLIE, J. R. **Softwood substitutes from the Guianas.** *Wood* 5, 1940 (84-6).

Soft hardwood species from the Guianas, British Honduras, and the West Indies are classified under the utility categories suggested by the author for West African timbers [Cf. *For. Abs.* 2, (44)]. A table is given to show the total and accessible forest areas of these colonies. The Guiana forests are richer in top-storey species than those of West Africa, and the yield should thus be correspondingly greater. The possible yield from the forests at present reckoned as exploitable, which cover an area of 50,000 sq. miles, is estimated at about 1¼ million cu.m.

31 : 33 : 12.2. DESCH, H. E. **Douglas Fir versus Baltic Redwood.** *Wood* 5, 1940 (96–100).

A popular refutation of the common opinion that Douglas Fir is inferior to Baltic Redwood (*Pinus sylvestris*). In many properties Douglas Fir is the superior timber.

31.1. *Form. Size. Structure. Anatomy. Identification*

31.1 : 12.2. **Department of Scientific and Industrial Research, Forest Products Research Laboratory, *Project* 9—Study and description of the structure and general properties of timber, *Progress Report* 4, Part 3—A lens key to hardwood timbers.** Forest Products Research Laboratory, Princes Risborough, Bucks. 1940. pp. 8 + plates and tables.

31.1 : 12.14 : 12.2. HEIMSCH, C. **Wood anatomy and pollen morphology of *Rhus* and allied genera.** *J. Arnold Arbor.* 21, 1940 (279–91). [Biological Laboratories, Harvard University.]

The members of the *Rhus* group of the Anacardiaceae may be divided according to either wood anatomy or pollen morphology into six groups corresponding with the six genera used in Barkley's classification of the North and Central American species of the complex, namely *Rhus*, *Cotinus*, *Toxicodendron*, *Metopium*, *Malosma*, and *Actinocheita*. The structure of the xylem in these groups is distinct from that of other genera in the tribe Rhoideae. Though the taxonomic status of the groups remains a matter of opinion, the study emphasizes the value of anatomical data as a supplement to ordinary methods of classification.

31.1 : 12.2 (94). DADSWELL, H. E., and ECKERSLEY, A. M. **The wood anatomy of some Australian Lauraceae with methods for their identification.** *Bull. Coun. sci. industr. Res. Aust.* No. 132, 1940. pp. 48 + plates. (*Tech. Pap. Div. For. Prod. Aust.* No. 34.)

The wood anatomy of thirty-one Australian species of the family Lauraceae is described and illustrated by photomicrographs, together with details of the habit and distribution of the trees and the general properties of the timbers. The Australian representatives of the family fall into two groups on the basis of their wood anatomy, (i) *Beilschmiedia*, *Cryptocarya* and *Endiandra*, and (ii) *Cinnamomum*, *Litsea* and *Persea*; these groups correspond to the botanical

sub-divisions Lauroideae and Persoideae. A key for identifying the woods of the Australian species is provided.

31.1 : 12.11 : 12.14. MILANEZ, F. R. Observacões sobre as celulas do lenho. [**Observations on xylem cells.**] *Anais da Primeira Reunião Sul-Americana de Botânica* 3, 1938 (189–221). [Port.e.] Repr. P.R.

Observations were made on the metaxylem of *Araucaria angustifolia*, *Combretum grandiflorum*, *Ruprechtia lundii*, *Guazuma ulmifolia* var. *tomentosa*, *Sterculia elata*, *S. speciosa*, *Ochroma lagopus*, *Virola bicuhyba*, and *Vatairea guianensis*.

Tannoid degeneration of the vascular elements was detected in all the 8 dicotyledons examined. The disintegration products migrate towards the longitudinal or radial parenchymatous cells adjoining the vessels. The tannoid substance in the ray cells was found to originate in three ways, (1) entirely from the vascular elements (exogenous), (2) in the ray initials, which were found to have small tanniferous vacuoles (endogenous), and (3) both endogenously and exogenously. In (2) the tannoids migrate to the wood parenchyma cells, which show reduced activity and appear to be replaced functionally by septate fibres. In (3) the tannoids migrate to ray or wood parenchyma adjoining the vessels.

Three types of leucoplast are described, two in the fibres and one in the ray cells. Of the former one has spherical starch grains with distinct concentric structure and the other is elongated, with the starch grains attached to each other laterally; in the third type the grains are found in the interior of the plastids and remain covered by the stroma for some time; the latter often shows oil drops, apparently as a result of degeneration.

The author's observations on *Guazuma ulmifolia* var. *tomentosa* confirm the work of M. M. Chattaway on tile cells, except that it is maintained that the cells develop from the division of initials in the cambium, and that these divisions are far more frequent than those of the procumbent-cell initials.

Other observations showed that: (i) Tile cells lose their living contents, usually beginning at the 4th or 5th cell from the initial in the wide rays, and a little later in the narrow ones, except in the cells adjoining vessels, which remain alive with a nucleus and frequently a large calcium oxalate crystal. (ii) The mother cells of the tile cells and of the corresponding elements of phloem rays show calcium oxalate crystals that are often re-dissolved. In the first instance this may be related to the early death of the cells, and in the second, to the formation of mucilaginous sacs. The crystals of some other phloem elements are also re-dissolved when the phloem fibres are formed. (iii) The cell contents seem to have a definite influence on the type of ray cell; the elements corresponding to the tile cells, both in the xylem and in the phloem, have clear contents rich in starch and calcium oxalate; the procumbent cells, with contents rich in tannin, form homogeneous rows through xylem, cambium, and phloem.

The genesis of the calcium oxalate crystals begins with a thickening of the ectoplasm, which develops into an intra-cellular vesicle in the interior of which the crystal grows just as in a mother solution. This vesicle, constituting the crystal sheath, initially of a plasmatic nature, may disappear entirely (*Ruprechtia*; *Guazuma*, in certain radial cells); more frequently, however, it yields a ligno-cellulosic membrane, more or less related to the cell wall.

31.1 : 12.14 : 31.3. PRESTON, R. D., and ALLSOPP, A. **An X-ray examination of delignified and cellulosan-free cellulose and its significance for the problem of the structure of cell walls.** *Biodynamika* No. 53, 1939. pp. 8. [Department of Botany, University of Leeds.] L.S.

(1) The removal of lignin and xylan from coir and from the wood of various trees causes no fundamental change in the X-ray diffraction pattern of cellulose. (2) Lignin removal involves a decrease in the angular dispersion of the cellulose chains and, in coir, a slight change in their orientation. The removal of cellulosans from the delignified material has little further effect. (3) These results support the conception that lignin occurs in the 'intermicellar' spaces and not within the cellulose micelle itself. *Authors' summary.*

31.1 : 12.14 : 31.3. FARR, W. K. **Structure and composition of plant cell membranes.** *Nature, Lond.* 146, 1940 (153–5). [Cellulose Laboratory, Boyce Thompson Institute for Plant Research.]

31.1 : 31.3. DADSWELL, H. E., and ELLIS, D. J. **Contributions to the study of the cell wall. I. Methods for demonstrating**

lignin distribution in wood. *J. Coun. sci. industr. Res. Aust.* 13, 1940 (44–56). (*Division of Forest Products Repr.* No. 70.)

Recent work on the relation between the occurrence of lignin in the secondary wall and the mechanical and pulping properties of wood is briefly reviewed and attention drawn to the need for a simple technique for routine investigations of the extent and arrangement of cell-wall lignin. Treatment of sections with 72 per cent. sulphuric acid alone was not satisfactory in hardwoods owing to excessive swelling, but, combined with gentle warming of the slide, this method is successful in revealing the cell-wall pattern; in some cases pretreatment of the sections with a 3 per cent. solution of iodine in potassium iodide was effective. In some instances no pattern could be demonstrated by any method.

The degree of lignification as indicated by the cell-wall lignin pattern is closely correlated with that revealed by staining reactions using safranin and light green. The pattern on cross section was predominantly radio-concentric; exceptions were compression-wood tracheids and anomalous fibres in some hardwoods. The possibility of a correlation between thickness of cell wall, cell-wall pattern and the staining reaction with safranin and light green is mentioned.

31.2. *Physical Properties*

31.2 : 12.2 (943). **Timber quality of young Eucalypts.** *News Lett. Qd. For. Serv.* No. 23, 1940 (10–11).

Progressive increase in density from the very light wood near the pith to the normal density wood near the bark in the larger diameter stems was pronounced in fast-grown *E. pilularis* and *E. microcorys*, but only slightly so in *E. paniculata*. The wood from small trees was generally of a fair quality and, although light in weight, brittle heartwood was negligible. The wood near the pith showed a more pronounced tendency to collapse in seasoning.

31.22. Relation to Water, Air, Gases

31.22 : 07.7. **Methods of determining the moisture content of wood.** *Pamphl. N.S.W. For. Comm. Div. Wood Tech.* No. 1, 1939 [?]. pp. 12. P.R.

31.23. Weight. Specific Gravity

31.23 : 12.2 (52). NAGASAWA, T. **Net density of the wood substance.** *Bulteno Scienca de la Fakultato Terkultura, Kyūsyū Imperia Universitato* 8, 1939 (321–5). [Jap.e.] P.R.

Details are given of a method of determining the density of powdered wood substance free from errors due to the adsorption of air. A special technique enables the specimen to be weighed *in vacuo* and subsequently in distilled water without coming into contact with air. A table is given to show the results of determinations made by this method on the wood of 35 Japanese tree species [of which only the Japanese names are quoted]. The mean specific gravity for all species is calculated as 1·60. *From author's summary.*

31.23 : 56–7 : 11 : 12.2 (71.3–6). HALE, J. D., and PRINCE, J. B. **Density and rate of growth in the Spruces and Balsam Fir of eastern Canada.** *Bull. Dom. For. Serv.* No. 94, 1940. pp. 43. [Forest Products Laboratories, Ottawa.]

The material sampled was chiefly in pulpwood sizes and was obtained from 70 different mixedwood and softwood stands distributed over a range of territory extending from the neighbourhood of Kenora in western Ontario to the coastal regions of New Brunswick and Nova Scotia in the extreme east. The averages for the various stands indicated normal ranges of variation for basic density (in grams of oven-dry substance per cubic centimetre of saturated wood) of about 0·31 to 0·36, 0·34 to 0·39, 0·40 to 0·48, and 0·37 to 0·40, for Balsam Fir, White Spruce, Black Spruce, and Red Spruce, respectively. While rapidly grown wood was light in weight and slowly grown wood relatively heavy, the rate of wood production of rapidly growing trees on a basis of total weight far exceeded the amount produced by slow-growing trees, and it appears therefore that the latter will be relatively uneconomical for pulpwood production. 'Basic wood increment' or 'B.I.', indicating oven-dry weight in pounds of commercially useful wood produced per sq. in. of basal area per year, was used as a general criterion for comparing the site quality of the various stands of pulpwood tested. The comparison (for 8-inch d.b.h. trees) revealed very much the same range of variation in the Spruces and in Balsam Fir. The highest B.I. noted was a trifle over ·06 in a stand of Black Spruce, and the lowest—

about ·012—was also for this species. The B.I. of Black Spruce definitely increased toward the east where more equable climatic conditions favour a higher growth rate and better tree form. White Spruce, on the other hand, appeared to have a higher B.I. toward the west.

31.3. *Chemical Properties*

31.3 : 12.2. POWERS, J. L., and CATALINE, E. L. **Crystalline tannin from the bark of *Acer spicatum*.** *J. Amer. pharm. Ass.* [Sci. Ed.] 29, 1940 (209–11). [University of Michigan.] L.S.

31.3 : 12.2. BRICKMAN, L., PYLE, J. J., HAWKINS, W. L., and HIBBERT, H. **Structure of the ethanolysis products from Spruce and Maple wood.** *J. Amer. chem. Soc.* 62, 1940 (986). [McGill University, Montreal.] O.R.S.

Two constituents of the 'aldehyde fraction' obtained in the ethanolysis of Maple and Spruce wood, previously identified in error as syringoyl- and vanilloyl-acetaldehydes, prove to be methyl-4-hydroxy-3, 5-dimethoxyphenyl diketone and methyl guaiacyl diketone, respectively.

31.3 : 12.2. GODARD, H. P., MCCARTHY, J. L., and HIBBERT, H. **Hydrogenation of wood.** *J. Amer. chem. Soc.* 62, 1940 (988). [McGill University, Montreal.] O.R.S.

Maple and Spruce wood meals readily underwent hydrogenation, the chief products isolated being 4-*n*-propylcyclohexanol-1 and 4-*n*-propylcyclohexanediol-1, 2. These substances are clearly derived from the lignin of the wood. The combined yields of both substances, calculated on the total (Klason) lignin originally present, amounted to about 60–70 per cent. in Maple and about 35–40 per cent. in Spruce meal. The carbohydrate-polysaccharide components of the wood also underwent simultaneous hydrogenation and hydrogenolysis, and the nature of these processes and their products is under investigation.

31.3 : 34.24 : 12.2. MCGOOKIN, A., ROBERTSON, A., and WHALLEY, W. B. **The chemistry of the 'insoluble red' woods. Part I. Pterocarpin and Homopterocarpin.** *J. chem. Soc.* 1940 (787–95). [University of Liverpool.] P.R.

31.3 : 33.32 : 01. **Holocellulose in wood. TAPPI Tentative Standard T9m–40.** *Paper Tr. J.* 110 (22), 1940 (27). P.R.

A tentative standard method of determining holocellulose in wood is described.

31.3 : 33.32 : 12.2 (52). UEDA, Y., and NEBU, T. **Wood chemistry. XIII. Chemical composition of Korean Rakuyosho (*Larix dahurica* var. *coreana* Nakai).** *Cellulose Ind., Tokyo* 15, 1939 (48–9, 211). [Jap.e.] Chem. Abs. 34 (3078). P.R.

31.3 : 33.32 : 12.2 (7). MOTTET, A. L. **The sulfonation of Western Hemlock lignin.** *Pacif. Pulp Paper Ind.* 13 (10), 1939 (22–5). Chem. Abs. 34 (3079). P.R.

31.4. *Durability. Decomposition*

31.42. Attack by Plant Organisms

31.42–3 : 33.4 : 12.2 : 13.2. DESCH, H. E. **Design in relation to correct utilization of timber.** *Malay. For.* 9, 1940 (51–65).

The risk of fungal decay can best be eliminated by keeping the moisture content of wood below 20 per cent. and by proper ventilation, or by the use of naturally durable species or a suitable wood preservative. Powder post beetles can be eliminated by using timbers that are for all practical purposes immune, such as Red Meranti (*Shorea* spp.), or susceptible timbers free from sapwood. Subterranean termites can be controlled by providing a barrier just above ground level, either by raising the whole structure 3 or 4 ft. off the ground or by use of a metal termite barrier. The complete exclusion of sapwood is probably an effective method for the control of dry-wood termites. Buildings should be inspected regularly and kept in condition. Instead of painting timber buildings externally they should be oiled or painted with a mixture of creosote and Diesel fuel. *From author's summary.*

31.42–3 : 12.2 (94). **Durability of Grey Ironbark.** *News Lett. Qd. For. Serv.* No. 23, 1940 (14–5).

Eucalyptus paniculata timber exposed to the weather or in contact with the ground shows high resistance to fungi but the wood is susceptible to attack by termites and marine borers of the shipworm type.

31.42 : 12.11 : 12.2. YATSENKO-KHMELEVSKI, A. A., and VASILEVSKAYA, L. M. La réaction des cellules vivantes du bois de hêtre abattu à la propagation du champignon. **[The reaction of the living cells of felled Beechwood to the growth of *Fomes igniarius*.]** *C. R.*

Acad. Sci. U.R.S.S. (*n.s.*), 26, 1940 (709–12). [F.]. [Botanical Institute of Tiflis, Georgian Branch of the U.S.S.R. Academy of Sciences.] O.R.S.

Freshly cut Beechwood test pieces, of which some were killed by formaldehyde or alcohol and others used with the cells still alive, were exposed to attack by *Fomes igniarius* and examined periodically. In dead wood attacked by the fungus the 'plastic' substances all gradually disappeared, tannic substances and starch being the first to go. Starch was probably transformed into sugar, which also disappeared or became much diminished by the end of the test. The disappearance of tannic substances and sugar coincided with the first signs of destruction of the cell walls. In some heavily infected test blocks the vessels showed an accumulation of hyphae and the products of their activity, which were brown and formed macroscopic brownish spots and streaks on the wood. Complete coloration of infected dead wood was not observed. In living wood fungal attack rapidly transformed all the 'plastic' substances into a brownish liquid, provisionally termed the 'myco-infiltrate', which filled the entire cavity of the living cells and subsequently accumulated in the fibre and vessel cavities. The infiltration of this liquid imparted a brown coloration to infected living wood; its formation must be regarded as a reaction of living cells to the fungus, since it was not observed in dead wood. Vigorous formation of tyloses took place only in infected samples and not in controls. Tyloses were absent from the samples treated with formaldehyde, but alcohol killed only the peripheral wood and tylose formation occurred in the interior. The results show that it is possible to distinguish between infected and traumatic wood, and to determine whether infection took place while the cells were still alive. It is emphasized, however, that other fungi might have other effects upon wood.

31.42 : 12.11 : 12.2. BAVENDAMM, W., and REICHELT, H. Die Abhängigkeit des Wachstums holzzersetzender Pilze vom Wassergehalt des Nährsubstrates. **[The dependence of the growth of wood-decomposing fungi upon the water content of the nutrient substratum.]** *Arch. Mikrobiol.* 9, 1938 (486–544). [G.g.]. [Abt. Baum-u. Holzkrankheiten, Forstbotanisches Institut Tharandt.] L.S.

The moisture requirements of 12 important timber fungi, mostly true wood-decomposing species, were determined with the aid of common salt solutions of different relative vapour pressure in closed glass vessels. As expected, the minimum and optimum humidities—and consequently the equilibrium moisture contents of the culture media in contact with the air—differed for the different species, but were constant under like conditions. The nature of the substratum (malt agar, sawdust, sound or infected wood) had no effect upon this result. Some of the fungi, notably those with a luxuriant superficial mycelium, e.g. *Merulius lacrymans* and *Poria vaporaria*, must be regarded as mesophilous under Walter's classification, since their minimum water requirement at 24° C. coincided with a relative vapour pressure of 90·4 per cent., or a moisture content of 16·6–16·9 per cent. in the wood used. The majority, however, were xerophilous, with a minimum water requirement lying at 85·6 per cent. relative vapour pressure, or 15·2–16·1 per cent. moisture content in the wood. *Stereum frustulosum*, which specializes on Oak heartwood, was the most extremely xerophilous of the species tested and has also several other features that adapt it to its unusual mode of life. The results lend support to Walter's view that a relative vapour pressure of 85 per cent. is the lower limit for active life, at least for the species and temperature employed; in contrast to Walter's opinion, however, the optimum for growth usually lay below 100 per cent. relative vapour pressure. These experimental results cannot be applied without qualification to wood as normally used, but they do show that fungal attack, when initiated by intact mycelium, is possible at moisture levels below the fibre saturation point of wood. The critical point for attack must be regarded as occurring in extreme cases at about 15 per cent. moisture content of the wood, a conclusion that supports long-standing empirical observations. *From authors' summary.*

31.42 : 12.11 : 12.2. GÄUMANN, E. Über die Temperaturansprüche des Hausschwammes. **[On the temperature requirements of the dry-rot fungus.]** *Zbl. Bakt.*, Abt. 2, 101, 1940 (409–10). [G.] R.A.M. 19 (378).

Recent outbreaks of *Merulius lacrymans* in cellars with a maximum temperature of 10° C. suggested the existence of a strain able to thrive under colder conditions than those usually regarded as the optimum (18–22°). Cultures showed that the optimum temperature

for the fungus was 15–18°; fair growth, resulting in destruction of about 7 per cent. of the wood, was made at 0°; the minimum apparently occurred at —2° instead of 3°; and the maximum of 24–27° C. was the same as for ordinary strains of the species.

31.42 : 12.11 : 12.2. HATTORI, T., and TAMURA, T. **On the effect of electricity upon the growth of wood-destroying fungi.** *Ann. phytopath. Soc. Japan* 9, 1939 (211–22). [Jap.e.] R.A.M. 19 (379).

Poria vaporaria, *Polystictus sanguineus*, and *Schizophyllum commune* were exposed to direct, alternating, and high-frequency currents run through (*a*) a piece of wood placed on a fungal mat growing on culture medium, (*b*) the fungi on a culture medium, and (*c*) the fungi grown on a piece of wood. It was found that the current checked growth and destroyed the fungus at a point where density of current was great. Direct current was more effective than alternating current, and high-frequency current had little effect. The checking of growth is ascribed to heat, the electrolytic production of toxins, movement of charged substances and migration of nutrients due to electro-endosmosis, and, also, destructive action. Experiments showed that the first two effects were insufficient in themselves to check growth. As colouring matter diffused out of cells of *P. sanguineus*, electro-endosmosis would seem to exert a marked effect upon the growth of these fungi.

31.42 : 12.2. CHIDESTER, M. S. **A pink stain of wood caused by a species of *Geotrichum*.** *Phytopathology* 30, 1940 (530–3). [Bureau of Plant Industry, U.S. D.A.]

A fungus isolated from pink-stained Southern Yellow Pine sapwood and heartwood that is morphologically like a fungus isolated from the heartwood of Cypress and from Oak, was found to be capable of producing the same colour in the heartwood and sapwood of Loblolly Pine, Yellow Birch, Cypress, Western Hemlock, Black Spruce, Silver Fir, Red Oak, and Douglas Fir. It has been classified as a species of *Geotrichum*. *Author's summary.*

31.42 : 12.2. CROWELL, I. H. **Heart bluestain of White Spruce and Balsam Fir.** *Woodlands Rev.* 11 (7), 1940 (3–4). [McGill University, Macdonald College, Quebec.]

The description of blue-stained specimens recently received from Shelter Bay, Quebec, of which almost the entire heartwood was stained, while the sapwood was free from attack. Only one other report of heartwood bluestain is known to the author, a case described from a single slow-growing Spruce tree in Norway.

31.42 : 33.36. SCHEFFER, T. C., and LINDGREN, R. M. **Stains of sapwood and sapwood products and their control.** *Tech. Bull. U.S. Dep. Agric.* No. 714, 1940. pp. 123. [Division of Forest Pathology, Bureau of Plant Industry.]

Stains due to chemical changes in the wood occur in the sapwood of a number of hardwoods and also in eastern and western Pines while they are seasoning. Blue stain is caused by fungi which attack the wood rays, and in general it does not affect the utility of the wood except in appearance. Toughness is the only strength property that may be significantly reduced by blue stain. Moderate stain has no practical effect on resistance of sapwood to decay, gluing qualities or paintability of wood or on its use in the manufacture of paper, on the drying rate and equilibrium moisture content of wood, or on the response of dry wood to preservative treatment. Moisture and temperature are the most important of the natural factors influencing the development of blue-stain fungi.

Wood that contains 20 per cent. or less water will not stain, and practical control of blue stain lies in (1) rapid seasoning, and (2) treatment of freshly cut stock with chemicals that will prevent growth of the stain fungi. [*For. Abs.* 1 (278)].

31.42 : 32.2 : 32.8 : 33.32. RILEY, C. G. **Deterioration in piled pulpwood.** *Woodlands Rev.* 11 (7), 1940 (2). [Dominion Forest Pathological Service.]

From the preliminary results of an experiment begun in 1932 with Black Spruce, White Spruce, Balsam, and Jack Pine, it appears that peeling is an important factor determining the rate of decay. In all cases, peeled wood considerably outlasted unpeeled wood. An unfavourable result of peeling in some instances was excessive checking of the wood.

31.43. Attack by Animal Organisms

31.43 : 13.2. **Borer holes which do not matter.** *Leafl. N.S.W. For. Comm. Div. Wood Tech.* No. 1, 1939. pp. 3. P.R.

Pin-holes left by ambrosia beetles and larger holes made by the Cypress Pine borer affect only the appearance of timber and are permitted in specified numbers in certain categories of grade A timber in Australia.

31.43 : 33.36 : 13.2. **Combating borers in furniture timbers.** *Furniture Trades Review*, Feb. 1940, pp. 4. (Division of Wood Technology, Forestry Commission of N.S.W. Reprint No. 1.) P.R.

Popular article on the control of *Lyctus* and *Anobium*.

31.43 : 12.2 : 13.2 (729). WOLCOTT, G. N. **A list of woods arranged according to their resistance to the attack of 'polilla', the dry-wood termite of the West Indies, *Cryptotermes brevis* Walker.** *Carib. For.* 1 (4), 1940 (1–10). [E.e.span.]. [Agricultural Exp. Sta., Rio Piedras, Puerto Rico.]

31.43 : 33.36 : 13.2. HARVEY, P. A. **The common dry-wood termite.** California Agricultural Experiment Station, Berkeley, California. 1939. pp. 4.

Notes on biology of *Kalotermes minor* (Hagen) and on preventive and control measures.

31.43 : 33.36 : 13.2. HERMS, W. B. **Control and prevention of the western subterranean termite.** California Agricultural Experiment Station, Berkeley, California. 1939. pp. 4.

Notes on *Reticulitermes hesperus* Banks.

31.45. Injury by Fire

31.45 : 33.36. **Fire-retardant paint.** *Industr. Engng. Chem.* (News Ed.). 18, 1940 (404). P.R.

According to tests made at the U.S. Forest Products Laboratory the best fire-retardant paints are linseed-oil paints containing finely ground borax. These offer considerable resistance to the spread of small fires, though they do not protect wood against continuous exposure to high temperatures. White lead is the most satisfactory pigment, but titanium or zinc-chloride pigments are also effective. Typical formulas are:—

Percentage by weight

Pigment	(Basic carbonate-white lead).	(Titanium-calcium)	(Lithopone)
	41·0	30·0	24·0
Borax	32·0	35·0	39·5
Raw linseed oil	22·8	30·8	32·3
Turpentine	3·6	3·6	3·6
Japan drier	0·6	0·6	0·6

At least 8 gallons per 1,000 sq. ft. (3 or 4 thick coats) are needed for maximum fire protection. The paints are not satisfactory for outdoor use, owing to leaching out of the borax by rain. Painting properties and fire retardance of paints stored for 1 year in a can equalled those of the freshly prepared mixture. White-lead/borax paint retains its effectiveness after 30 months' exposure to different interior humidity conditions, but is still capable of much improvement. Yellowing takes place indoors, but this can probably be reduced by modifying the vehicle. Since the paints are still in the developmental stage, their use is recommended only where resistance to fire is the paramount requirement.

31.8. *Defects of Timber*

31.8 : 07.7. **Electrical detector finds metal in logs.** *Sth Lumberm.* 160 (2021), 1940 (54).

A brief description is given of this piece of equipment which has been developed by the Forest Service Radio Laboratory, Portland, Oregon. In operation a metal coil is passed along the log 2 or 3 in. from the bark and when it nears a piece of metal the attached earphones emit a howl.

31.8 : 33.32 : 31.42–3. HANSEN, G. M. **New plastic makes clears from defective lumber.** *Timberman* 41 (6), 1940 (11–12, 48).

A new wood-flour plastic has been evolved for use in plugging holes in Douglas Fir timber made by the larvae of *Criocephalus productus*, and also pitch pockets and small knot holes, thus raising lumber to a grade commensurate with its strength and durability. The plastic successfully withstood severe wetting and drying tests and a 73-day attack by the wood-rotting fungi *Lenzites trabea* and *Poria incrassata*,

and adhered firmly to the wood throughout the tests. Like wood it can be sawn, planed, painted, or varnished, is grease- and water-proof and will hold nails and screws.

32. HARVESTING OF WOOD. LOGGING

32 : 07.7. RUSSELL, W. C. **Wire rope uses and sizes in logging work.** *Sth. Lumberm.* 160 (2021), 1940 (50–2). [Macwhyte Co., Kenosha, Wis.]

32.2. *Felling. Extraction*

32.2. NEWLIN, J. A. **Falling timber with less damage.** *Timberman* 41 (8), 1940 (11–3). [Forest Products Laboratory, Madison, Wisconsin.]

Note on the principle causes of timber breakage with suggestions for further research on that subject.

32.2 : 07.7. HILF, H. H. Zweckmässiges Wenden mit zwei einfachen Wendehaken. **[Practical log turning with two simple cant hooks.]** *Forstarchiv* 15, 1939 (403–8). [G.g.] L.S.

The simple hooks used in the Palatinate are suitable for diameters ranging from 14 to 75 cm.; hence it appears unnecessary to employ adjustable hooks. Each worker in a two-man crew should receive a hook weighing about 1·5 kg. Two such light hooks are neither heavier nor more expensive than one adjustable tool. The hooks should have rings sufficiently wide and mobile to assure ease of handling. The pole can be short and light.

32.2 : 82 : 12.2 (43.1–5). PLATZER, H. B. Leistungsuntersuchungen im Kiefernhauungsbetrieb. **[Performance studies on the felling of Pine.]** *Forstarchiv* 15, 1939 (371–80). [G.g.]. [Institut für forstliche Arbeitswissenschaft, Eberswalde.] L.S.

The time studies described (time required to fell and sort a unit volume of timber without bark) confirmed Bergknecht's data (*Iffa Drucksache* D90). It is pointed out that thoroughly trained crews of workmen must be employed in such studies.

32.2 (91). WILKINSON, G. **Tandem buffalo dragging.** *Malay. For.* 9, 1940 (81–2).

The same primitive tracks are used for tandem dragging as for single buffalo dragging, hence no additional capital costs are required for the extraction of large logs.

32.2 : 37 : 07.7. **Adjustable balancing log bunk.** *W. Cst. Lumberm.* 67 (6), 1940 (52).

By means of a screw adjustment operated by a tubular socket wrench, the log bunk may be moved sideways a maximum distance of 5 in. in either direction from the central position. In this way an offbalance load of logs can be equalized, the tendency for the load to shift is eliminated, and the number of the tire blowouts reduced.

32.2 : 37 : 07.7. **New methods in Simpson's truck feeder operation.** *W. Cst. Lumberm.* 67 (6), 1940 (12–3).

Tow cars are used in hauling log loads of about 10,000 bd. ft. up long 4 to 10 per cent. grades. These cars are loaded with rock or dirt to help traction and are attached to the main truck by a special coupling and draw-bar arrangement held in horizontal position by means of cables from the tow-car body, with a spring to take the pull in rounding curves. The empty trucks use narrow, steeply graded short-cut roads in returning to the operation.

32.3. *Sorting according to Final Products*

32.3 : 35 : 12.2. BENSON, A. O. **A new approach to hardwood log grades.** *Sth. Lumberm.* 160 (2022), 1940 (27–8). [Forest Products Laboratory, Madison, Wisconsin.]

Owing to the inadequacy of the defect method of log grading an attempt is being made at present to evolve log grades based on lumber grade specifications. The latter place emphasis on cuttings of specified sizes and, as a rule, do not pay much attention to defects. In grading logs by the new method it has been found convenient to visualize the log surface in quarters and then survey each face individually much as a board is inspected. At present three log grades are contemplated, the specifications for each setting up certain percentage yields in cuttings of certain sizes. Eventually it is hoped to arrive at log grades of country-wide applicability.

32.4. *Inventory and Evaluation of Felled Timber*

32.4 : 82 : 84. WENDOVER, R. F. **Useful check record for a logging camp.** *W. Cst. Lumberm.* 67 (6), 1940 (38–40).

A method of checking the efficiency of a logging operation by means of concise daily reports from each of the four main departments of work—(1) felling and cross-cutting, (2) yarding and loading, (3) transportation, and (4) mechanics' work. A miscellaneous group for special jobs is also included. Each department reports (1) location of work, (2) number of men, (3) cost, (4) results or output. Reports are checked by the timekeeper, and they also check one another.

32.7. *Loss in Logging*

32.7 : 52.4 : 12.2. BRANDSTROM, A. J. F., and FLANAGAN, G. C. **Volume losses in logging and marketing old growth Douglas Fir.** *Timberman* 41 (7), 1940 (17–22). [Pacific Northwest Forest & Range Exp. Sta.]

Despite favourable topography and great care in logging, which was done in four successive fellings with the use of tractors and arches exclusively, the discrepancy between gross and net volume scale, for a 600-year-old Douglas Fir stand, averaged one-third of the total volume. The trees varied from 50 to 90 in. d.b.h. and averaged 265 ft. high, and the stand contained an understorey of Hemlock and some Cedar.

The difference between gross and net scale was accounted for as follows: (1) Broken and culled sections left in woods and cull logs removed averaged 21 per cent. for all logs and varied with size of tree, the larger the diameter the higher the percentage of such loss for all logs except the sixth. (2) Reduction due to difference between gross woods scale and gross commercial water scale of the logs utilized averaged 6 per cent. of the total volume. (3) Deductions from the gross water scale for defect and breakage averaged 10 per cent. of the total volume. This factor was closely correlated with position of log, the higher logs having the larger percentage deduction.

33. CONVERSION AND PRESERVATION OF WOOD

33.13. Cooperage. Shingles

33.13 : 34.26. CUNO, J. B. **Wooden rosin barrels.** Forest Products Laboratory, Madison, Wisconsin. 1939. Chem. Abs. 34 (3068). P.R.

33.15. Manufacture of Veneers and Laminated Wood. Gluing

33.15 : 12.2 (410). **Economies in home-grown timber.** *Wood* 5, 1940 (188–9).

Recent experiments at the Forest Products Research Laboratory, Princes Risborough, have shown conclusively that home-grown timbers such as Beech, Alder, Birch, Sycamore, and Poplar can be used for plywood manufacture without any real difficulty. Timber can be saved by using plywood in place of solid wood for many purposes.

33.15. Wellholz—Aufbau und Eigenschaften. **[Corrugated wood—construction and properties.]** *Holztechnik* 20, 1940 (69–70). [G.] P.R.

An account is given of the construction and physico-mechanical properties of laminated boards with a core built of alternate plies of corrugated and flat Beech veneer.

33.15. **An improved construction of laminated material.** *Patent Specification* 503,094. 31st Mar. 1939. H.M. Stationery Office, 1939. pp. 6. P.R.

33.15. **Improvements in and relating to composite articles.** *Patent Specification* 505,625. 11th May, 1939. H.M. Stationery Office. 1939. pp. 3. P.R.

33.15 : 31.27. BERNHARD, R. K., PERRY, T. D., and STERN, E. G. **Superpressed plywood bonded with thermosetting synthetic-resin adhesives.** *Mech. Engng., N.Y.* 62, 1940 (189–95). [Pennsylvania State College, & Resinous Products & Chemical Co., Philadelphia.] L.S.

An account is given of the influence of details of construction and species of wood upon the strength values of superpressed plywood. Test results are tabulated and graphed.

33.15 : 33.36 : 33.32. **Permali. Some notes on resin impregnation of wood and the production therefrom of constructional material for electrical and engineering purposes.** *Plastics* 4, 1940 (41–3). P.R.

A popular review of the manufacture and uses of Permali, a laminated compressed wood impregnated with synthetic resin.

33.3. *Chemical Treatment*

33.3. FRIEDLANDER, C. J. **A new method of bending wood.** *Wood* 5, 1940 (137–8).

The wood is treated with a solution containing 0·1 to 1 per cent. of a tanning agent to which a small quantity of organic solvent such as amyl acetate may usefully be added. The wood should be in the solution one or more days, depending on its thickness and character; a temperature somewhat higher than ordinary will hasten the treatment. Wood thus treated can be wound, folded or bent to form articles of all kinds and shapes without the application of heat or pressure and without the wood losing its structure, strength, elasticity, or finishing qualities, and it can be stamped or modelled with ease.

33.3 : 31.3 (73). BENSON, H. K. **Recent advances in the chemical utilization of wood in the United States.** *Atti X° congr. intern. chim.* 4, 1939 (105–16). Chem. Abs. 34 (1845). P.R.

Wood as a source of paper pulp, cellulose derivatives, staple fibre, naval stores, wood-distillation products, synthetic lumber and wood plastics.

33.32. Pulp and Paper Manufacture

33.32. BOEHM, R. M. **Plastics and chemicals from wood.** *Paper Tr. J.* 110 (18), 1940 (35–8). [Masonite Corp., Laurel, Miss.] P.R.

A semi-popular review of products made by the Masonite Corporation.

33.32 : 09.4 : 98.3 (43.1–5). ZEYHER. Das Faserholz und seine Erzeugnisse im deutschen Aussenhandel im Zeitraum 1927 bis 1938. **[Pulpwood and its products in German foreign trade in the period 1927–38.]** *Allg. Forst- u. Jagdztg.* 116, 1940 (94–102). [G.] [Institut für Forstpolitik der Universität Freiburg.]

Annual imports of pulpwood and its products in terms of pulpwood volume amounted to 4·4 million solid cu. m. during 1936–8, i.e. 1·5 million cu. m. less than during 1933–5; exports totalled 2·5 and 1·5 million cu. m. in 1937 and 1938, respectively; home consumption (including creation of war reserves) increased from 6·2 million cu. m. in 1937 to 9·5 million cu. m. in 1938, when 7 million cu. m. were obtained from cuttings corresponding to 150 per cent. of the normal yield. Including Austria and the Sudeten country, total normal production is estimated at 7 million cu. m. and the total internal consumption at 11 million cu. m. It is suggested that production could be raised to 10 million cu. m. by more careful sorting of material now used as fuel, and by increased utilization of Pine, Beech, and substitute materials such as rags, old paper, straw, &c. for the manufacture of pulp, while consumption could be lowered to the same figure by more carefully husbanding semi-finished and finished products. Even so, Germany will have to import pulpwood in order to maintain her exports of pulpwood products. In 1938, the pulpwood industry showed a positive foreign trade balance of 79 million RM.

33.32 : 12.2. JAYME, G., and SCHORNING, P. Beziehung zwischen Alter des Rotbuchenholzes und des aus ihm isolierbaren Anteils an resistenter Reincellulose. **[Connexion between the age of Common Beech wood and the amount of resistant pure cellulose that can be isolated from it.]** *Papierfabrikant* 38, 1940 (69–74). [G.g.]. [Institut für Cellulosechemie der Technischen Hochschule Darmstadt.] P.R.

Wood from trees 60–110 years old gave higher yields of resistant pure cellulose, averaging 36·83 per cent., than that of older or younger trees. The connexion between age and yield was evident even in wood from stands in different forest districts.

33.32 : 31.3 : 12.2 (51). MIURA, I., and NAKATUKA, T. **Manchurian woods for manufacture of pulp. IV. Cooking of hardwoods.** *Cellulose Ind. Tokyo* 15, 1939 (50–2, 218–20). [Jap.e.] Chem. Abs. 34 (3080). P.R.

33.32 : 12.2. CHIDESTER, G. H., and MCGOVERN, J. N. **Effect of acid concentration and temperature schedule in pulping resinous woods.** *Paper Tr. J.* 110 (10), 1940 (39–42). [Forest Products Laboratory, Madison, Wisconsin.] P.R.

An increase in the sulphur dioxide concentration and the use of lower temperatures, together with a longer cooking time, have a beneficial effect in pulping Jack Pine, Douglas Fir, and Southern Pine. Further studies are necessary, particularly for the Southern Pines and Douglas Fir, to determine the extent to which growth variables might affect the results. *From authors' summary.*

33.32 : 31.3 : 12.2 (52). NISIDA, K., MIYAMA, R., and SOEZIMA, J. **Chemical investigation of wood substances. XIII. Sulfite pulps from forest thinnings and their properties.**

Cellulose Ind., Tokyo 15, 1939 (45–8, 203–10). [Jap.g.] Chem. Abs. 34 (3080). P.R.

The woods of *Cryptomeria japonica, Chamaecyparis obtusa, Pinus densiflora*, and *P. thunbergii* were cooked by the sulphite process and the chemical constituents of their bleached (two-stage) pulps were determined.

33.32 : 31.3 : 12.2 (51). SHIKATA, M., YAMANE, M., and KIN, H. **Pulp woods of Manchoukuo. V. Analysis of and cooking experiments with 'Dahurica-Karamatsu'.** *J. agric. chem. Soc. Japan* 15, 1939 (542–6). B.C.P.A. 1939, Sec. B. (924). P.R.

With reference to *Larix dahurica* Turcz.

33.32 : 31.3 : 12.2 (52). HUKUDA, Y. **Pulps. XIV. Sulfite cooking of Larch from Honsyû. 2.** *Cellulose Ind., Tokyo* 15, 1939 (29–32, 154–7). [Jap.g.] Chem. Abs. 34 (3082). P.R.

33.32 : 31.3 : 12.2. (52). HUKUDA, Y., and HORIO, M. **Disintegration of Larch wood from Honsyû by the sulphate cooking process.** *J. Soc. chem. Ind., Japan* 42, 1939 (367–9). [G.] Chem. Abs. 34 (3079). P.R.

33.32 : 12.2. BRECHT, W., SCHRÖTER, H., and SÜTTINGER, R. Der Einfluss des Holzalters auf das Verschleifen von Kiefernholz. **[The influence of age of the wood on the mechanical pulping of Scots Pine.]** *Papierfabrikant* 38, 1940 (77–9). [G.]. [Institut für Zellstoff- und Papiertechnik an der Technischen Hochschule Darmstadt.] P.R.

Scots Pine wood from trees between 50 and 90 years old did not differ significantly in mechanical pulping characteristics and gave pulps of similar properties. Wood from 30-year-old trees required rather more power to grind, but yielded pulps with considerably better strength properties. Young Pine free of heartwood has pulping characteristics that scarcely differ from those of Norway Spruce. The marked difference at more advanced ages is due to the formation of resin in the heartwood of Pine.

33.33. Manufacture of Textiles from Wood

33.33 : 33.32 : 12.2 (485). HÄGGLUND, E. Undersökningar beträffande framställning av konstsilkemassa av björk. **[Investigations on the manufacture of Birch rayon pulp.]** *Svenska SkogsvFören. Tidskr.* 38, 1940 (105–52). [Sw.g.]

In northern and central Sweden, and in certain regions of southern Sweden, about 15 per cent. of the forest consists of Birch (*Betula pubescens* and *B. verrucosa*), and about 80 per cent. of the Birch felled has been used for firewood. The present investigation was started in an effort to find better ways of utilizing this mass of raw material. Samples of the two species were treated singly and in mixture by the sulphite process. Successful cooking was achieved in all cases except typical 'curly Birch', but there were considerable differences in ease of delignification, not only between samples from different trees but also between those from the same tree. The residual lignin of Birch proved much harder to extract than that of Spruce, and a point was always reached where the percentage of lignin could no longer be reduced because the cellulose carbohydrates (pentosans) were removed as fast as, if not faster than the lignin fraction. This point sometimes occurred at a relatively high lignin content. Various means of bleaching can be employed. The pulp obtained after chlorine bleaching in two stages (chlorine water; bleaching powder) at first had too high a benzole extract, which gave trouble in the filtering of the viscose, but a clear viscose was obtained in later trials. From tests of the pulp in the laboratory of a rayon factory it appeared that rayon and other viscose products of completely satisfactory properties can be prepared from Birch wood. Super-α-cellulose is readily extracted from the wood, and from this a cellulose acetate of the highest grade was prepared.

33.34. Dyeing of Wood

33.34. SINGER MANUFACTURING CO. **Coloring wood.** *Brit. Patent* No. 509, 968, 25th July, 1939. Chem. Abs. 34 (4252). P.R.

The wood is coloured by subjecting it in a closed receptacle to NH_3 gas under temperature conditions resulting in vaporization of the H_2O content thereof, interrupting the treatment when the pressures internally and externally of the wood approach a balance by creating a partial vacuum in the receptacle and thereafter repeating the treatment with NH_3. The NH_3 may be used with or without live steam. The shell of the cylindrical receptacle is preferably preheated to 325° F.

33.35. Seasoning. Drying

33.35. **Air seasoning of timber.** *Leafl. N.S.W. For. Comm. Div. Wood Tech.* No. 2, 1940. pp. 3.

33.35. **Air distribution in the dry kiln.** *Timberman* 41 (8), 1940 (32).

The conclusions from an experiment undertaken recently to determine the degree to which the uniformity of air flow through a pile of 1-inch boards is influenced by (1) the width of space for air entrance, (2) projecting edges on the side where the air enters, and (3) thickness of stickers.

33.35 : 12.2 (59.1). BARBER, H. **Air drying tests on Burma timbers.** *Burma For. Bull.* No. 33, 1940. pp. 70. [Utilization Circle, Rangoon.]

Graphs showing the rate of drying and data on seasoning degrade, moisture-content variation in seasoned wood, maximum shrinkage, and ratio of tangential to radial shrinkage, are given for 50 species of Burma timbers. The tests were confined to only a small number of samples for each species, and these samples were placed in racks and well spaced for ease of handling. While the information thus obtained is not directly applicable to normal commercial air-drying conditions, it nevertheless indicates the comparative general behaviour of the different woods.

33.35 : 31.22 : 12.2. STEGEMAN, J. D. **Density segregation. Reasons for sorting uppers on green chain according to moisture content.** *W. Cst. Lumberm.* 67 (6), 1940 (30, 74).

As the kiln-drying time for a one-inch Redwood board varies from 9 to 37 days, depending on density, it is advisable to sort the upper logs on the green chain into those of light, medium and heavy wood. This may be done by determining the percentage of summer wood by visual inspection, after first eliminating those pieces containing a considerable amount of compression wood.

33.35 : 33.4 : 12.2. MATHEWSON, J. S. **The air seasoning of Eastern Hemlock lumber with reference to building construction.** Northern Hemlock and Hardwood Manufacturers' Association, Oshkosh, Wisconsin. 1939. pp. 7. [Forest Products Laboratory, Madison, Wisconsin.]

33.35 : 33.16 : 07.7. DIXON, C. E. **An artificial dryer for wood wool.** *J. Coun. sci. industr. Res. Aust.* 12, 1939 (354–8). (*Div. For. Prod. Repr.* No. 64). [Division of Forest Products, C.S.I.R.]

The design and operation are described of a dryer capable of dealing with 200 lb. (wet weight) of wood wool per hour. The wood wool is carried on a slatted endless belt and uniform circulation is secured by passing the air through instead of across the conveyor. Structural details are shown in diagrams.

33.36. Preservation of Wood. Impregnation

33.36 : 12.2. **The paintability of British Columbia Red Cedar.** *B.C. Lumberm.* 24 (7), 1940 (52–3).

33.36. FOX, K. R., HYRY, E. C., and HATFIELD, I. [to Monsanto Chemical Co.]. **Composite polychlorophenol product suitable for preserving wood, etc.** *U.S. Patent* No. 2, 180, 142, Nov. 14, 1939. Chem. Abs. 34 (1834). P.R.

A solid homogeneous fused mass having a conchoidal or vitreous fracture, that is soluble in petroleum solvents of the fuel oil boiling range, consists essentially of a polychlorophenol such as tetra- or pentachlorophenol, which normally tends to bloom when applied as a solution to wood, and a resin such as rosin or ester gum compatible with the polychlorophenol and soluble in such petroleum solvents in a proportion sufficient to prevent substantial blooming when the compound is applied as a solution to protect wood from decay organisms and fungi.

33.36. FOX, K. R., and HATFIELD, I. [to Monsanto Chemical Co.]. **Tableted polychlorophenol salts suitable for preparing solutions for wood treatment.** *U.S. Patent* No. 2,188,944, Feb. 6, 1940. Chem. Abs. 34 (3902). P.R.

A formed compressed coherent mass is formed mainly of a compound such as Na pentachlorophenate having a moisture content of 3–20 per cent. and containing NaOH 1–10 per cent., readily soluble in water, prepared by compressing the powdered material, granulating the compressed material, and then moulding.

33.36. STEINHERZ, D. **Fluorine compounds as wood preservatives. A review of methods of application.** *Canad. Chem. Process Industr.* 23, 1939 (601). R.A.M. 19 (379).

33.36 : 31.42. LEHTINEN, E. Timmerbevattningsmetoden. **[The timber-spraying method.]** *Papp. Trävarutidskr. Finl.* 21, 1939 (816–8, 820). [Sw.] R.A.M. 19(447).

An account of the Runbäck method of spraying wood (floating or dry) for the prevention of bluing (*Phialophora fastigiata* and *Pullularia pullulans*). It is stated to be almost universally applied in the timber industry throughout Sweden.

33.36 : 31.42 : 12.2 (73). HUBERT, E. E. **Toximetric method for oil-soluble wood preservatives.** *Industr. Engng. Chem.* [Analyt. Ed.] 12, 1940 (139–41). R.A.M. 19 (378).

Details are given of the technique, developed by the Preservative Standards Advisory Committee of the U.S. National Door Manufacturers' Association, for determining the minimum requirements for various properties of toxic chemicals, e.g. toxicity and permanence in wood, and for properties of the treating solution, e.g. concentration of toxic agent, flash point, volatility, and resistance to leaching. Kiln-dried *Pinus ponderosa* sapwood is prescribed as the test wood, and the fungi to be used are approved strains from the Forest Products Laboratory of *Lenzites trabea* (for decay) and *Hormiscium gelatinosum* (for staining).

33.36 : 31.43 : 13.2 (74.9). HEADLEE, T. J., and JOBBINS, D. M. **Some effects of acid arsenate of lead used against the termite, *Reticulitermes flavipes* (Kollar).** *J. econ. Ent.* 32, 1939 (638–40). R.A.E. A28 (353–4).

Satisfactory control was achieved with acid lead arsenate, the lowest dosage given being 0·8 oz. per cu. ft. of soil. The cost of treating soil on the site of a future building would be comparatively small.

33.36 : 31.43. CHRISTIAN, M. B. ***Lyctus* beetle damage prevention. Second report on chemical dip tests against *Lyctus* powder-post beetles, *Lyctus parallelopipedus* (Melsh.) and *Lyctus planicollis* Leconte.** *Sth. Lumberm.* 160 (2021), 1940 (47–9).

Tests were made of a large number of dips for protection against *Lyctus* attack of green lumber while air-drying and of seasoned lumber in storage. The only method that has been tested on a commercial scale and has given favourable results is a ten-second dip within a 5 per cent. borax solution, which should be applied at a temperature of 180° F. Laboratory tests indicate that while this treatment controls *L. parallelopipedus*, it may not be as effective against the larger beetles (*L. planicollis*). Laboratory tests indicate that a treatment even more effective than borax is a ten-second dip in 1 per cent. and 2 per cent. solutions of 'Sulfocide' and other finely divided sulphur materials, applied at 190° F.

Tests show that for the control of *Lyctus* in seasoned wood, a three-minute dip of 1-inch and thinner boards within a 3 per cent. solution of pentachlorophenol in light fuel oil will kill the *Lyctus* present in the wood and render it immune from further attack.

33.36 : 31.43 : 13.2. CANN, F. R. **Experiments in Great Britain with wood preservatives for the prevention of *Lyctus* attack.** *Forestry* 14, 1940 (27–37). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

The different types of preservatives and their suitability for the prevention of *Lyctus* attack are briefly discussed. Materials, methods of treatment, and testing technique are described and the results of the tests are summarized in tabular form. The value of the preservatives and different methods of application tested are classified under the headings 'Effective' and 'Ineffective'. It is shown that water-soluble preservatives are effective only when applied by an impregnation treatment. Certain preservatives of the oil and solvent types are effective when applied by short-period dipping treatments. *From author's summary.*

33.36 : 31.43 : 13.2. HANLEY, W. W. **Creosote used in fighting marine borer.** *Mar. News* 26 (10), 1940 (55–7). L.S.

Examples are given of pressure-creosoted piles that have resisted attack by marine borers for periods up to 42 years. Damage to untreated wood has been reported from as far north as Newfoundland. As improved sewage disposal in New York is decreasing pollution and thus favouring the borers, it is particularly important that waterfront structures should be built of treated wood. The use of treated wood in a recent pier building is described.

33.36 : 31.46 (73). HUBERT, E. E. **Comparing the relative effectiveness of water-repelling and retarding solutions in wood. A laboratory method.** *Industr. Engng. Chem.*

[Anal. Ed.] 12, 1940 (197). [Western Pine Association, Portland, Oregon.] P.R.

A detailed specification is given for a tentative standard method, provisionally approved by the Preservative Standards Advisory Committee of the U.S. National Door Manufacturers' Association and submitted by them for trial and improvement.

33.36 : 33.51 (91). THOMAS, A. V. **Experiments with impregnated pit props.** *Malay. For.* 9, 1940 (74–7).

Note on three experiments with a number of indigenous timbers, the preservative used being a mixture of creosote and Diesel fuel.

33.36 : 33.52. LUDWIG, W. **Impregnated wood poles, etc.** *U.S. Patent* No. 2,186,648, Jan. 9, 1940. Chem. Abs. 34 (3468). P.R.

A process for the impregnation of fresh, sappy, wood poles, masts or timbers involves providing air openings near the centre of the length thereof and extending substantially completely through the sapwood, then simultaneously forcing impregnating fluid into each end of the pole, driving the sap of the pole out of the openings ahead of the fluid and continuing the introduction of the fluid until it passes out of the openings.

33.36 : 33.52 : 07.7. ERNST, M. L. **X-raying poles. 'Next patient please'.** *Timberman* 41 (7), 1940 (11, 47). [Detroit Edison Co.]

The equipment and technique used in taking X-ray pictures (radiographs) of power-line poles, at ground line, to determine the proportion of sound and unsound wood. The formation of parallel lines on the radiograph, indicating the difference in density between springwood and summerwood, is a check that the wood has not disintegrated. Gradual fading of the X-ray penetration, as opposed to abrupt ending, is also indicative of sound wood.

33.36 : 33.52. NETTLES, W. C. **A new method of impregnating green fence posts. A preliminary report.** *J. econ. Ent.* 32, 1939 (703–4). R.A.E. A28 (361).

A method is described of treating non-durable green Pine posts with water-soluble preservatives. Satisfactory impregnation with copper sulphate was secured in several hundred posts; zinc chloride appeared to give less uniform penetration on some occasions. Immediately after cutting, the tops of the posts are immersed for 3 hrs. in a trough of a solution containing 2 lb. of the preservative to each U.S. gal. of water. A disk 1 in. thick is then sawn from the butt of each post to remove resinous material and the butt is placed in the solution. After 24–48 hours the posts are removed, the ends reversed and the posts stood up for 2–4 weeks, and preferably until thoroughly seasoned. The posts should receive $\frac{3}{4}$ lb. preservative to each cu. ft. of wood.

33.36 : 33.52. STARKER, T. J. **Preservative treatment of fence posts. 1938 progress report on the Post Farm.** *Bull. Ore. agric. Engng. Exp. Sta.* No. 9, 1938. pp. 21.

33.36 : 33.52. STARKER, T. J. **Preservative treatment of fence posts. 1939 progress report on the Post Farm.** *Bull. Ore. agric. Engng. Exp. Sta.* No. 9-A, 1940. pp. 5.

The test that is applied to determine failure of a post is a 50-pound pull at 2 ft. from the ground. The first report gives a detailed record of the post series under observation at that time. Five series of posts, all untreated, had failed 100 per cent. after being in the ground for varying periods, and the woods represented are considered unsuitable for permanent fence lines. These species with average period before failure are: Cottonwood 55 months, Alder 69 months, Madrone 69.6 months, Bigleaf Maple 76 months, and Douglas Fir 84 months. White Fir and Ash also give failures in a relatively short time. The treatment of Douglas Fir with $ZnCl_2$ and the charring of wooden posts have been found ineffective in prolonging the life of posts in this region. This report also contains appendices dealing with 'Wood requirements for farm fences', 'Salt treatment for posts and poles', and 'The open-tank process." The second report gives records of additional post series under observation after 1938.

33.38. Charcoal Manufacture. Charcoal. Use of Wood in Power-Gas Generators. Producer Gas

33.38. **Producer gas.** *Pamphl. N.S.W. For. Comm. Div. Wood Tech.* No. 4, 1940. pp. 14.

A simple explanation of the use of producer gas made from charcoal in the propulsion of vehicles.

33.38. **Charcoal burning. Portable kiln and pit methods.** *Pamphl. N.S.W. For. Comm. Div. Wood Tech.* No. 5, 1940. pp. 15.

33.38 (485). BERGSTRÖM, H. Bränsle för gengasdrift. **[Fuel for producer gas.]** *Skogen* 27, 1940 (152–3). [Sw.]

The large-scale production in Sweden of cheap, uniformly high-grade charcoal still presents serious difficulties from the economical and technical points of view, and these difficulties are aggravated by times of crisis. In the author's opinion it would be better to concentrate on the use and further development of gas producers that can be run on wood directly, or on inferior, imperfectly carbonized grades of charcoal. Generators should be designed to run on either type of fuel.

33.38 (941). ROBERTS, R. P. **Producer gas equipment on tractors in Western Australia.** *J. Dep. Agric. W. Aust.*, Ser. 2, 15, 1938 (391–402). K.

A review of the present position of producer gas for farm tractors in Western Australia, based on 67 answers to a detailed questionnaire. The disadvantages of producer gas used in ordinary petrol engines have been increased capital expenditure, some reduction in power, a decrease in reliability, lack of knowledge on the part of the operator, and some increase in the daily service work. On the other hand considerable savings have been effected in fuel and oil costs. Whether the advantages outweigh the disadvantages will depend on the type of tractor, the purpose for which it is used, the way in which it is used, and the skill of the man who uses it.

33.4. *Converted Structural Timber*

33.4 : 12.2 (944). **N.S.W. timbers for building scantlings.** *Leafl. N.S.W. For. Comm. Div. Wood Tech.* No. 3, 1940. pp. 7.

33.5. *Roughly Converted Wood*

33.52. Poles, Masts, Piles, Stakes

33.52 : 31.45–6. GARWOOD, G. T. **Tests on wood poles. Determining shock and fire risks.** *Elect. Rev., Lond.* 126, 1940 (423–5). L.S.

In tests of imitated insulator failure on wooden power-line poles it was found that (*a*) complete failure of primary insulation on 11KV 'unearthed' construction is likely to cause rapid destruction of the pole and cross-arm under the 'Petersen coil' conditions of 11KV to earth; (*b*) under such conditions dangerous or even fatal shocks are obtainable from the pole within easy reach of ground level; and (*c*) plain earthing collars of the type employed are worse than useless owing to their spurious appearance of safety. In practice, however, these dangerous conditions seldom exist since they are brought about by a combination of circumstances each of which is comparatively rare.

33.52 : 33.36 : 31.27 : 12.2. **Tests on strength of creosoted posts.** *Wood Pres. News* 18, 1940 (74, 79). P.R.

Pressure-treated posts may be used in sizes giving the actual strength required; for, as they remain sound, no allowance need be made for dimensional losses caused by decay. Tests have recently been made on creosoted round Lodgepole Pine posts of various diameters, which were buried to depths of 2½ or 3 ft. and tested when the ground was frozen to a depth of 11½ in. The test load was applied as a horizontal pull at a height of 3 ft. 4 in. above ground level. Posts with a top diameter of 3 in. sustained an average maximum load of 1,162 lb., those with a top diameter of 4 in. an average load of 2,362 lb., and those of 5 in. diameter an average load of 4,625 lb. These figures indicate that creosoted Lodgepole Pine posts of even less than 3 in. top diameter are strong enough for all fencing requirements.

33.8. *Other Manufactured Products*

33.8. ANDERSON, E. W., and SPAULDING, L. H. **Wood pipe and its expanding markets.** *Univ. Wash. For. Cl. Quart.* 13, 1939–40 (13–9).

33.8 : 12.2. *Tech. Bull. Calif. Redwood Ass.* Nos. 16–2 to 16–11, 1938–9.

Popular information leaflets on Redwood tanks for breweries, chemical plant, distilleries, food products plant, petroleum industries, pulp and paper mills, soap plant, tanneries, textile and allied plant, and wineries.

33.9. *Storage of Converted Timber*

33.9 : 07.7. **Engineered lumber handling.** *W. Cst. Lumberm.* 67 (6), 1940 (16–8).

The green lumber is put up in units 44 in. high, 38 in. wide and containing 1,000 bd. ft. of lumber in random lengths, with nine ¾ in. × 2½ in. stickers in each course. The unit is carried to the storage yard on a special carrier

and placed in stacks four units deep and four units high by means of an automatic stacker. Each stack is on a foundation of four short posts of 4 × 12 in. material with 6 × 6 in. material on top, and the ground under the stack slopes 6 in. in 20 ft. so that the lumber will shed rain. After air drying the lumber is transferred by units to the kiln.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

34.25 : 12.2. CHEVALIER, A. Produits médicinaux fournis par les plantes de la famille des Guttifères vivant dans les colonies françaises. **[Medicinal products furnished by plants of the family Guttiferae growing in the French colonies.]** *Rev. Bot. appl.* 20, 1940 (88–97). [F.] P.R.

34.25 : 12.2. BOUTHIAUX, S. Notes sur la culture des Quinquinas et la consommation mondiale en quinine. **[Notes on the cultivation of the *Cinchonas* and the world consumption of quinine.]** *Rev. Bot. appl.* 20, 1940 (202–10). [F.]. [Abstract of paper by Kerbosch in *Bull. Inst. Amsterdam*, Dec. 1939 (36–51).] P.R.

34.25 : 12.2 (87). WILLIAMS, L. Algunos datos sobre el barbasco. **[Some notes on the Barbasco.]** *Boletin de la Sociedad Venezolana de Ciencias Naturales* No. 41, 1939 [?]. pp. 13. [Span.] Repr.

The name 'Barbasco' is applied in the Latin American countries to a number of species used for fish poison. Among the plants so used in Venezuela, one of the most toxic is said to be the 'Barbasco Blanco', a woody climber that is possibly identical with and certainly very closely related to *Lonchocarpus nicou* (Aubl.) DC. Analyses of root and shoot samples of this plant showed rotenone contents of between 0·37 and 1·77 per cent. by dry weight. The rather low percentage of rotenone may be due to one of several causes, but in view of the present commercial demand for rotenone and of the exploitation of 'Barbascos' in other South American countries as sources of this substance, it should be worth while investigating any such plants and the possibilities of bringing them into cultivation in Venezuela.

34.25 : 12.2 (72). El Linaloé y su aprovechamiento. **[Linaloe (*Elaphrium aloexylon*) and its utilization.]** *México Forestal* 18, 1940 (53–5). [Span.]

34.26 : 12.2 (931). BURNS, M. M., TAYLOR, N. H., DIXON, J. K., and HODGSON, L. **A survey of Tung groves in New Zealand.** *Bull. N.Z. Dep. sci. industr. Res.* No. 66, 1939. pp. 61. [Soil Survey Division, D.S.I.R., New Zealand.]

34.26 : 33.37 : 12.2. RITTER, E. **The distillation of Birch oil.** *J. For.* 38, 1940 (517–8). [U.S. Forest Service.]

Description of the home-made distillery and the simple process used by the operators, usually farm hands, in the Appalachian Mountains. *Betula lenta* is the species commonly used.

34.27 : 12.2 (78.9 : 79.1). LITTLE, E. L. **Estimates of the 1940 Piñon nut crop on national forests of New Mexico and Arizona.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 87, 1940. pp. 5.

34.28 : 12.2 (729.5). GREGORY, L. E. **Notes on the Yarey Palm of Puerto Rico and the straw industry derived from it.** *Carib. For.* 1 (4), 1940 (13–6). [E.e. span.]. [Tropical Forest Exp. Sta., Puerto Rico.]

34.3. *Products of the Animal Kingdom*

34.3 : 6. DAVEY, R. **Forestry for game.** *Quart. J. For.* 34, 1940 (74–80).

A conference paper in which recommendations are made on the management of wooded estates for the dual purpose of forestry and pheasant rearing. Under proper management there need be no incompatibility between the two pursuits.

34.6. *Utilization of Milling and Logging Waste*

34.6 : 07.7. **Compressed wood waste as fuel.** *Wood* 5, 1940 (143).

The wood waste is kiln dried, ground to uniform size and blown through conveyor pipes to a special pressing machine and formed into a solid, bone-dry 'log' having a density three times that of wood. Each log measures 12½ × 4 in., weighs 8 lb. and the pressing machine can turn out 2,500 every 24 hours. This fuel is known as 'Pres-to-Logs' [Cf. *For. Abs.* 1 (227)] and is being developed by Wood Briquettes Inc. of Lewiston, Idaho, U.S.A.

35. SALE AND DISPOSAL OF FOREST PRODUCTS

35 (410). **National rules for measuring hardwoods.** *Timb. News Sawm. Chron.* 48, 1940 (155–6).

35 : 12.2 (73). **Rules for grading American [Black] Walnut logs.** American Walnut Mfrs. Ass'n, Chicago. 1940. pp. 5.

35 : 32.3 : 12.2 (75–6). LUFBURROW, B. M. **Southern Pine saw timber conversion and log classification tables recommended.** *Sth. Lumberm.* 160 (2019), 1940 (51–2). [Southern Pine Association.]

This classification is the outcome of suggestions, discussion and criticisms by state and private foresters, loggers, lumbermen and purchasers throughout the southern Pine area. It is constructed for this area as a whole and may be adjusted to local operating or market conditions.

37. FOREST TRANSPORT

37 : 07.7 : 32.5 (71). WHITE, F. O. **Some economics of motor truck performance.** *Pulp Paper Mag. Can.* 41, 1940 (511–2). [Fraser Companies, Ltd.]

37 : 33.4. **Barging lumber to California.** *W. Cst. Lumberm.* 67 (7), 1940 (16).

Loads of 1,700,000 and 1,920,000 bd. ft. of lumber have been shipped by scow along the Californian Coast. The scow has a large hold and 12 × 12 in. stanchions rising above the deck which allow a 12 ft. deck load. Lashings tightened at the centre with turnbuckles and iron braces at the ends of the scow are used to keep the lumber firmly in place.

4. PROTECTION

43. FOREST FIRES

43.1. *Protective Measures*

43.1 (71.4). KIEFFER, H. **Forest protection in Quebec. Inflammability tests, radio and airplanes employed in fire fighting.** *Pulp Paper Mag. Can.* 41, 1940 (508–10, 516). [Quebec Department of Lands & Mines.]

43.1 (485). PERSSON, E. Skogseldsläcknings-kartor. **[Forest fire control maps.]** *Skogen* 27, 1940 (145–6). [Sw.]

The planning of fire-control operations could be greatly simplified if every district fire authority had copies of the official ordnance map on which existing natural fire barriers such as rivers, lakes, roads, and tracks, &c., were clearly marked, with some indication of their probable effectiveness. Efforts should be made to complete the network of such barriers and to strengthen them by appropriate measures such as the raising of strips of hardwoods, maintenance of clean firebreaks, &c.

43.1 (79.5 : 79.7). WILSON, H. **Fuel type mapping in the North Pacific Region.** *Univ. Wash. For. Cl. Quart.* 13 (2), 1939–40 (10–2).

For each fire district the forest fuels are evaluated according to rate of spread of fire and resistance to control on an August day, and map colours are used to show each fuel-type rating. Abbreviations denote the various ratings on the map and symbols indicate the timber type, the main factor determining rate of spread, the main factor causing resistance to control, the degree of slope, and the possibility of using machines on the area. There are four categories [low (L), medium (M), high (H), and extreme (X)] for rate of spread and resistance to control.

43.1 : 07.7. FUNKE, F. W. **Dwelling spark arresters.** *Fire Control Notes* 4 (2), 1940 (83–6). [Region 5, U.S. Forest Service.]

A design for a chimney spark arrester is suggested as a result of recent experiments.

43.1 : 07.7. STICKEL, P. W. **An automatic apparatus for detecting and reporting forest fires.** *J. For.* 38, 1940 (502–3). [Northeastern Forest Exp. Sta.]

This apparatus is described in U.S. Patent No. 2,177,493. The detecting device uses a photocell in conjunction with a thermocouple and as the corresponding relay contacts of each are connected in a series, the signal-sending device operates only when light is accompanied by a rise in temperature. The turret which contains this equipment is geared so that as it rotates it will follow changes in the profile of the surrounding horizon, and when both the photocell and thermocouple are energized it stops long enough to contact the central station, and from this signal the azimuth-bearing of the fire can be determined in relation

to the tower. Certain disadvantages of this apparatus are discussed. It is pointed out that these are not prohibitive and that, with the commercial price of manufacture being approximately $500.00, this type of equipment will probably be used in the future as part, at least, of fire-detection systems.

43.1 : 07.7 (71.3). McEwen, P. **Use of radio in forest fire protection in Ontario.** *For. Chron.* 16, 1940 (132–7).

It is pointed out that, where portability and low cost are important factors, radio is the preferable method of communication with isolated towers and fire-fighting units. The forest-protection radio equipment for Ontario in 1940 consists of 124 5-meter sets for use in towers, six special sets for boats and trucks, and 18 portables. The tower-type transmitter is operated from a 6-volt storage battery while three B batteries and a C battery are used for the receiver. A small gasoline motor is used to charge the storage battery. The radio antenna is, on an average, 90 ft. above the earth plus the height of the tower hill over surrounding country. Ranges of from 30 to 35 miles are customary though much greater distances have been covered satisfactorily. The complete cost of parts, including gas-engine charging unit, is about $200.00.

An advantage of these radio sets is simplicity of operation, while one disadvantage at present is lack of a strong signal to attract the towerman. To offset this a schedule of conversations is arranged between all towers of a group and the 'key' tower, the interval between conversations varying with hazard conditions. Each group of towers is assigned a frequency band within the general band for the Province.

Good results have been obtained in using a 5-meter tower set with a work crew in the woods and it is believed that the use of this type can be extended.

43.1 : 07.7. Dakan, A. S. **Use of the McLeod tool.** *Fire Control Notes* 4 (2), 1940 (80). [Region 2, U.S. Forest Service.]

A rake-and-hoe combination of use in clearing duff away from a fire line and in helping to put out ground fires.

43.1 : 07.7. Rice, T. A. **Trail tractor and trailmobile.** *Fire Control Notes* 4 (2), 1940 (93–9). [Region 6, U.S. Forest Service.]

Recent experimental work has shown that with the aid of the U.S. Forest Service trail tractor, for which specifications are included, 54 in. trails can be constructed at a lower cost than with hand labour. After the trail is completed, transportation of fire-fighting and other supplies can be accomplished by use of either the tractor with trailer carts or a trailmobile, which is a specially constructed miniature lorry.

43.1 : 11 : 01 (79.5 : 79.7). Morris, W. G. **Statistical analysis of fire weather station distribution.** *J. For.* 38, 1940 (318–21). [Pacific Northwest Forest & Range Exp. Sta.]

Determinations are made of the number of fire weather stations necessary for each ranger district in order to obtain an average daily wind velocity and an average daily minimum fuel-moisture index within certain limits of the true mean, for both mountain tops and other locations. The average size of a district is 300,000 acres.

43.1 : 11. Jemison, G. M. **The influence of locality, season, time of day, and year on the visibility of smoke columns.** *J. For.* 38, 1940 (435–7). [Appalachian Forest Exp. Sta.]

Three years of measurement at 50 lookout stations on eastern national forests show that average visibility distance varies significantly with different localities and this should be recognized in detection planning. Effects of season, hour of day, and year on visibility are less important but should be allowed for on the basis of current haze meter measurement. *From author's summary.*

43.1 : 11.1 : 07.7. Byram, G. M. **A plains haze meter.** *J. For.* 38, 1940 (401–3). [Appalachian Forest Exp. Sta.]

The description of an instrument used for measuring the visibility distance of small smokes in flat or rolling country.

43.1 : 11.44 : 07.7. Byram, G. M. **The Appalachian fuel moisture scale.** *J. For.* 38, 1940 (493–5). [Appalachian Forest Exp. Sta.]

The description of a simple scale for weighing moisture indicator sticks having dry weights between 75 and 115 grams, by which the percentage moisture content of the stick is read directly from the scale dial. Errors in reading will not exceed 0·1 per cent. for low moisture contents and 0·5 per cent. for moisture contents of 40 or 50 per cent. The theory of the scale is explained and illustrated.

43.1 : 82. CLIFF, E. P., and ANDERSON, R. E. **The 40-man crew—a report on the activities of the experimental 40-man fire suppression crew.** *Fire Control Notes* 4 (2), 1940 (47–62). [Region 6, U.S. Forest Service.]

The thoroughly trained and highly mobile crew proved a success in reducing considerably the cost of fire-line construction. The crew were equipped to sustain themselves in inaccessible country for periods of at least 3 days.

43.1 : 82. MATTHEWS, D. N. **Crew size affects fire fighting efficiency.** *For. Res. Note Pacif. Nthwest. For. & Range Exp. Sta.* No. 29, 1940. pp. 10.

Greater efficiency will result from having the fire-fighting crew divided into relatively small units and transported to different parts of the fire line by motor (where possible) rather than having the crew as one unit moving from point to point by walking. The relative efficiency of small crews is most pronounced where fuel types have low to moderate resistance to control.

44. PROTECTION AGAINST DAMAGE BY HARMFUL PLANTS

44.1. *Forest Weeds*

44.1 : 23 : 12.19.2 : 12.2 (921). DANHOF, G. N. Bijdrage tot oplossing van het alang-alang-vraagstuk in de Lampongsche Districten. **[Contribution to the solution of the Lalang problem in the Lampong Districts (South Sumatra).]** *Tectona* 33, 1940 (197–225). [Du.e.]

The influence of shifting cultivation, land reclamation by Javanese colonists, and fire upon the spread of Lalang grass (*Imperata cylindrica*) in South Sumatra is discussed. Certain types of shifting cultivation are dangerous and should be controlled by local regulations. Colonization appears to be relatively harmless as yet, but might become dangerous on certain lands if no regulations are imposed. Fire is an important factor, the only one that perpetuates Lalang under the local climatic conditions; hence much may be done if the native indifference to fires can be corrected by education and punishments. Experiments with *Ochroma bicolor* in mixture with soil-protective species such as *Leucaena glauca*, *Euphorbia geniculata*, *Aeschynomene* sp., *Sesbania sesban*, and *Eupatorium pallescens* have shown that artificial reforestation of Lalang areas, though possible, is not remunerative and gives doubtful results on poor soils. Provided that adequate fire protection is assured, natural regeneration may be expected to occur within a reasonable time; it is therefore recommended that artificial regeneration should be used only to fill in thinly stocked portions of the fire-resistant forest strips that would be necessary to protect regeneration areas. The cheapest way to establish protective strips would be to raise species such as *Lantana camara*, *Melastoma malabathricum*, *Blumea balsamifera*, and *Erechthites hieracifolia* by direct sowing, or the first two of these by cuttings, and to introduce *Schima bancana* without preparing the soil but with intensive fire protection in the initial stages of establishment.

44.1 : 23.2 : 12.2 (54.2). ANVERY, S. A. A. **Grass and Teak plantations.** *Indian For.* 66, 1940 (285–6).

It is suggested that unchecked grass growth in Teak plantations, and the consequent soil impoverishment of nitrogenous matter, may, in some cases, be partly responsible for premature flowering and fruiting of Teak, and for the related phenomenon of lessening or stoppage of vegetative growth.

44.1 : 44.3 : 12.12 : 12.2 (73). OFFORD, H. R., ATTA, G. R. VAN, and SWANSON, H. E. **Chemical and mechanical methods of *Ribes* eradication in the White Pine areas of the western States.** *Tech. Bull. U.S. Dep. Agric.* No. 692, 1940. pp. 49. [Bureau of Entomology & Plant Quarantine.]

Methods that have been developed for the control of *Cronartium ribicola* where *Ribes* eradication by ordinary hand work is not efficient. 'Atlacide', essentially a mixture of $NaClO_3$ and $CaCl_2$, is applied at the rate of 960 pounds per acre to kill *R. petiolare*. The fire hazard arising from the use of $NaClO_3$ under forest conditions is reduced by its combination with $CaCl_2$, $NaHCO_3$, or borax. For greatest economy the treatment for susceptible *Ribes* such as *R. petiolare* should be a practically lethal dosage that will kill 99–100 per cent. of the plants, whereas for resistant species such as *R. inerme* the treatment should be first a dosage of maximum efficiency, which will kill about 81 per cent. of the plants, supplemented in the following year by a practically lethal dosage for the surviving plants. Large or troublesome individual *Ribes* plants are killed

by decapitation and treatment with Diesel oil, a mixture of dry $NaClO_3$ and borax in the proportions of 1 : 5, dry NaCNS, or a saturated solution of NH_4CNS. A specially constructed bulldozer was found to be cheaper and more effective than either hand slashing or chemicals for the permanent suppression of *R. inerme* associated with dense brush. For this purpose the solid blade used for removing dirt is replaced by a strongly built frame holding a series of digging teeth. Brief comments are included on special eradication methods such as ploughing, blasting, burning and flooding. Knapsack spray tanks, portable power sprayers, and special Diesel oil canteens and syringes have been devised for the application of chemicals in the forest.

44.3. *Fungi*

44.3. HORSFALL, J. G., HEUBERGER, J. W., SHARVELLE, E. G., and HAMILTON, J. M. **A design for laboratory assay of fungicides.** *Phytopathology* 30, 1940 (545–63). [Connecticut Agricultural Exp. Sta.]

44.3 : 23.27. YOUNG, H. C. **Fungicides and their use on ornamentals and shade trees.** *Arborists' News, Nat. Shade Tree Conf.* 5, 1940 (33–6). Pl. Sci. Lit. 11 (22), (1).

45. PROTECTION AGAINST DAMAGE BY ANIMALS

45.3. *Insects*

45.3 : 12.12 : 12.2 : 13.2 (69). FRANÇOIS, E. Un ennemi du Giroflier à Madagascar. [**An enemy of the Clove Tree in Madagascar.**] *Rev. Bot. appl.* 20, 1940 (116–7). [F.] P.R.

Clove trees in Madagascar have been damaged and sometimes killed by *Xyleutes* sp. (probably *X. cretaceus*), a moth whose larvae tunnel in the main branches and trunk. Attacks were observed as long ago as 1933 and have since spread considerably. The only effective control measure is to cut off and burn the infested parts, and penalties will be imposed on any planter failing to take such action.

45.3 : 12.12 : 12.2 : 13.2 (73). MCDANIEL, E. I. **Mid-summer sprays with lead arsenate to control the Hickory bark beetle.** *Quart. Bull. Mich. agric. Exp. Sta.* 22, 1940 (243–5). [Michigan Agricultural Exp. Sta.]

The Hickory bark beetle (*Scolytus quadrispinosus*) has two generations a year in Michigan, the adults of the first generation emerging about the third week in June. At this time the bark beetles feed for 3–5 days on terminal growth or at the base of leaves, before entering the bark. These feeding activities are indicated by the large number of fallen leaves. The first spray was applied at this time to terminal growth, foliage, and under the bark, and a second application was made six weeks later only under the bark. From these experiments on a highly susceptible stand of Shagbark Hickory, in which beetles had been active for three or four years, it was found that one thorough application of lead arsenate, using 4 pounds to each 100 gallons of water, plus a sticker-spreader, is effective when applied at the critical midsummer feeding period.

45.3 : 12.2 : 13.2. PERSON, H. L. **The Clerid *Thanasimus lecontei* (Wolc.) as a factor in the control of the western Pine beetle.** *J. For.* 38, 1940 (390–6). [U.S. Bureau of Entomology & Plant Quarantine.]

Thanasimus lecontei is the most effective of a number of insect enemies of the western Pine beetle (*Dendroctonus brevicomis*). Adult clerids consume more than 25 beetles in a lifetime and the larvae feed on the beetle larvae, pupae and newly formed adults. Clerids concentrate on host trees of first-generation beetles and migrate to the bases of infested trees in the larval stage. Under controlled conditions beetle emergence averaged 146 per sq. ft. where clerids were excluded and 52 per sq. ft. where clerids were present.

The exposure of infested logs, with bark left intact, to solar heat during the summer months, on the flat or on southerly slopes, will result in a high percentage mortality of the bark-beetle broods without serious loss of clerids. The latter can escape to the lower part of the log and also are able to withstand high temperatures, which prove fatal to the western Pine beetle.

45.3 : 12.12 : 12.2 : 13.2. **Insect attack consequent on war-time fellings.** Forestry Commission, London. 1940. pp. 3. P.R.

A popular pamphlet giving practical control measures against *Myelophilus piniperda*, *M. minor*, and *Hylobius abietis*.

45.3 : 12.12 : 12.2 : 13.2 (74). DOWDEN, P. B. **Present status of the European Spruce**

Sawfly, *Diprion polytomum* (Htg.), in the United States. *J. econ. Ent.* 32, 1939 (619–24). R.A.E. A28 (350–1).

An account is given of the organization and results of an intensive survey carried out during 1937 and 1938 to determine the range of *Diprion polytomum* (*Gilpinia polytoma*) in the U.S.A. and the severity of infestation of Spruce. The sawfly occurs in Maine, Vermont, New Hampshire, and New York, the degree of infestation varying from place to place and from year to year. As yet few trees have been killed in these States, but over a large area trees have been so badly defoliated that their survival seems doubtful. The parasite *Microplectron fuscipenne* has been bred and liberated on a large scale and is established at several points; in addition small lots of other parasites, including *Exenterus marginatorius* have been imported from Canada and liberated.

45.3 : 12.12 : 12.2 : 13.2. POETEREN, N. VAN. Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1938. **[Report on the work of the Phytopathological Service in 1938.]** *Versl. PlZiekt. Dienst Wageningen* No. 93, 1939. pp. 92. [Du.] R.A.E. A28 (278).

In work on the control of *Chermes* (*Gilletteëlla*) *cooleyi* on *Pseudotsuga taxifolia*, 15 sprays, chiefly preparations of mineral oils, were tested in July. Examinations after a few weeks and in May, 1939 revealed no living aphids on trees sprayed with Summer Volck at 1 per cent., and very few on those treated with some of the other oil emulsions or a standard spray of nicotine and soap. Spraying in August gave very inferior results.

45.3 : 12.12 : 12.2 : 13.2 (73). WHITTEN, R. R., and BAKER, W. C. **Tests with various Elm-wood traps for bark beetles.** *J. econ. Ent.* 32, 1939 (630–4). R.A.E. A28 (352–3).

In 1935 five series of Elm-wood traps for *Scolytus multistriatus* and *Hylurgopinus rufipes* were prepared. They included felled trees replaced on their stumps, trees killed by auger-hole injections of sodium arsenite, partly severed branches, logs laid or stood on the ground or hung from Elm trees, and trees girdled ½–1 in. into the xylem. The chief species of tree in all but one of the areas was *Ulmus americana*. *S. multistriatus* preferred trees exposed to sunlight, and *H. rufipes* those in the shade. Felled trees were the most attractive: girdled trees did not die, and were therefore not attractive. In 1937 it was noted that trees killed with certain previously untried chemicals were more attractive than felled trees. Comparative tests were made in 1938 with felled trees placed on stumps, trees girdled at breast height 1 in. into the xylem, and trees treated with sodium chlorate (5 g. in 30 c.c. solution at 30 or 60 c.c. per in. diameter), ferrous sulphate (30 g. in 75 c.c. solution per in. diameter), copper sulphate (1 g. in 30 c.c. solution per in. diameter) and dry copper sulphate at 120 g. per in. diameter. Trees treated with sodium chlorate were the most attractive to *S. multistriatus* and more attractive than any except the felled trees to *H. rufipes*. In experiments later in the season, Elms treated with a water solution of sodium chlorate at 10 g. of the dry salt per in. diameter were significantly more attractive to *S. multistriatus* than felled trees. No galleries of *H. rufipes* were found.

45.3 : 13.1 : 13.2. KINOSHITA, E. Untersuchungen über die Yesoraubfliege *Promachus yesonicus* Bigot unter Berücksichtigung des Forstschutzes. **[Research on *Promachus yesonicus* in relation to forest protection.]** *Res. Bull. Coll. exp. For. Hokkaido Univ.*, Extra number 1940 (171–270). [G.g.]

Observations and experiments on the distribution of the insect in Japan, its biology, and its efficacy in the biological control of cockchafers. The development of cockchafer larvae in forest nurseries, especially of those belonging to the genus *Anomala*, can be successfully checked with the aid of *P. yesonicus* larvae.

45.3 : 13.2. TRAVIS, B. V., and DECKER, G. C. **Insecticides for June beetle control.** *J. econ. Ent.* 32, 1939 (607–11). R.A.E. A28 (348–9).

Adults of *Lachnosterna* (*Phyllophaga*) *implicita* Horn from *Ulmus americana* and *Salix* sp. were caged with dusted leaves of these trees. The leaves were sprayed with a mist of water and then given applications of dust equivalent to 1–1½, 3, or 4½ lb. per tree. Lead arsenate dust at these rates killed 74, 81, and 88 per cent. respectively of females that received the poisoned foliage on one night, and 90, 95, and 98 per cent. of those that received it on two successive nights. Similar applications of calcium arsenate dust killed 18, 36, and 51, and 52, 70, and 84 per cent., respectively. In tests with males mortality among controls was very

high. Magnesium arsenate and sodium fluosilicate were not effective, and 8 inert carriers and lead carbonate were apparently not toxic. Sprays containing lead or calcium arsenate and soap were less effective than dusts, as the waxy coating of the leaves, particularly of Willow, prevented even coverage. In field tests, 80·2 per cent. of beetles taken immediately they had finished feeding on foliage dusted with lead arsenate, and 29·3 per cent. of those from leaves dusted with calcium arsenate, died within 96 hours.

45.3 : 13.2. AMBROS, W. Biologische Nonnenfalterkontrolle. **[Biological control of the nun moth (*Lymantria monacha*).]** *Forstarchiv* 15, 1939 (323–9). [G.] L.S.

The use of captive female nun moths for luring male moths is a reliable means of keeping check on the moth population and of reducing to some extent the intensity of infestation. Examples quoted from recent practice include that of a Spruce forest of about 757 ha. in which, during one season, 384,448 males were attracted and destroyed by the use of 480 decoy females.

45.3 : 23.27 (76.6). FENTON, F. A. **Control of shade tree borers.** *Circ. Okla. agric. Exp. Sta.* No. 84, 1939. pp. 28.

Popular pamphlet discussing the biology and control of 15 of the more common and injurious species of wood-boring insects found in Oklahoma.

45.3 : 23.27 (77.3). FARRAR, M. D. **Control of borers in newly set shade trees.** *J. econ. Ent.* 32, 1939 (634–8). R.A.E. A28 (353).

A study of borer infestation in newly planted hardwood shade trees in Illinois. Wrapping the trunks for the first two growing seasons was the most practical method of control, and wrapping paper the most satisfactory and cheapest material. Trees in their third and subsequent seasons were seldom injured. About 20 per cent. of the trees were attacked in crotches and the trunk above the wrappings; most of this injury could be avoided by extending the wrappings upwards into the shaded portions of the trunk. Protecting the trunks from May to September, inclusive, was adequate.

45.3 (494). BARBEY, A. Fortifications de campagne et protection forestière. **[Military fortifications and forest protection.]** *J. for. suisse* 91, 1940 (100–4). [F.]

In pure conifer stands, trees felled and left lying in the forest for strategic purposes should be sprayed with a 30 per cent. solution of 'veraline' (a concentrated water-soluble carbolineum) to minimize insect hazard.

5. MENSURATION. INCREMENT. YIELD

51. *Instruments. Measures and Weights*

51 : 07.7. JAPING, R. Die neuen Holz-Messkluppen 'Bielefeld' und 'Rhede'. **[The new 'Bielefeld' and 'Rhede' timber calipers.]** *Forstarchiv* 15, 1939 (408–10). [G.] L.S.

The two calipers are scaled on the back, a feature claimed to facilitate the reading off of measurements. 'Rhede' is the lighter model of the two and is built for one-man work. A spring device allows of its being adjusted to the tree with one hand and subsequently released altogether by the operator, the caliper remaining in position on the tree. Thus the same man can do the calipering and recording.

51 : 32.3 : 32.7. BONNEY, M. C. **Use of the cull caliper in scaling White Oak stave bolts.** *J. For.* 38, 1940 (351–5). [U.S. Forest Service.]

In hewed stave operations the tree is cut into blocks of a given length and the blocks are split into stave bolts or sectors of the block cylinder, the number of bolts per block varying with diameter. Defective sectors must be scaled to determine the net scale of the tree. The instrument here described is applied to the end of the bolt and is so calibrated as to show the number of sectors of any size contained in the whole block of which the measured sector was a part, and also to show the percentage any sector is to the block from which it was cut. The method of using the caliper is described in detail with an example of its application.

52. MEASUREMENT OF TREES

52.2. *Height and Length*

52.2 : 12.2 (78.9). KRAUCH, H. **Merchantable length of White Fir and Limber Pine in relation to total height of trees.** *Res.*

Note Sthwest. For. & Range Exp. Sta. No. 83, 1940. pp. 3.

Table based on data from the Lincoln National Forest, New Mexico.

52.2 : 64. MEYER, H. A. **A mathematical expression for height curves.** *J. For.* 38, 1940 (415–20). [Pennsylvania State College.]

Computations are based on the method of least squares. The height of trees may be expressed in terms of age or diameter at breast height by the formula $Yc = H(1-e^{-aX})$, or in the latter case $Yc = 4{\cdot}5 + h(1-e^{-aX})$. Yc is the calculated height, H is a given maximum height, X is age or diameter at breast height as the case may be, and an approximation of the parameter a, which varies between 0·04 and 0·12 if diameter is measured in inches and height in feet, may be calculated from the observed data. The method may be used as a test of the significance between two or more height curves. It is applicable only for trees larger than 5 in. and older than 10 to 20 years.

52.4. *Volume. Volume Tables*

52.4. **Sorensen's cubic content log scale.** *Timberman* 41 (8), 1940 (36).

This log scale is based on top diameter and length and gives volumes in cubic feet. The taper allowance is 1/10 in. per linear foot.

52.4 (410). JERRAM, M. R. K. **Volume tables for British trees.** *Quart. J. For.* 34, 1940 (112–5).

A considerable proportion of trees now being felled in Britain are divided into logs and measured accordingly. Only a few additional records in the field would be required to complete the data necessary for the preparation of taper tables. Some tentative suggestions are made with regard to such an undertaking.

52.4 : 12.2 (77.1). DILLER, O. D., and KELLOGG, L. F. *Tech. Note Cent. St. For. Exp. Sta.* Nos. 2, 3, 4, 5, 6, 7, 8, 9, 1940.

Local volume tables for Cucumber (*Magnolia acuminata*), Basswood (*Tilia glabra*), Red Oak (*Quercus borealis*), Sugar Maple (*Acer saccharum*), Black Walnut (*Juglans nigra*), White Ash (*Fraxinus americana*), Hickories (*Hicoria* spp.), and White Oak (*Quercus alba*) in Stark County, Ohio.

52.4 : 34.24. CHIBELEANU, A. Scoarța de stejar. [**Oak bark.**] *Rev. Pădurilor* 52, 1940 (249–59). [Rum.f.]

Contains formulae for determining the Oak bark volume for individual trees and for stands, and also data on tannin content variation in relation to age.

52.4 : 61. TRIMBLE, G. R. **Measuring sample trees on a timber management survey.** *J. For.* 38, 1940 (518–9). [Bartlett Experimental Forest, Bartlett, N.H.]

A three-man crew was found to be most efficient; one man to measure heights, the second to measure diameters, make increment borings and help with height measurement, and the third to measure the increment core and take all notes. The crew is supplied with information as to number of sample trees wanted by size and species, and a rough description of the plots to be measured. Records are brought up to date after each day's work.

56. INCREMENT. DIAMETER, HEIGHT, AND VOLUME INCREMENT

56–7 : 12.2 (76.4). **East Texas Slash Pine experiments show good growth results.** *Sth. Pulp Paper J.* 3 (2), 1940 (18).

Slash Pine (*Pinus caribaea*), which is not indigenous to East Texas, was planted as 1–0 stock at 1,200 per acre on worn-out land, and after seven years' growth averaged 23 ft. high and 4·1 in. d.b.h., with a mortality of 15 per cent. of the trees planted. Pulpwood timber should be available in thinnings at the end of the first 10 years.

56–7 : 12.2 (79.5). MUNGER, T. T. **Thirty years' growth in Douglas Fir.** *Timberman* 41 (8), 1940 (17–8). [Pacific Northwest Forest & Range Exp. Sta.]

Note on statistics from three permanent sample plots which were established 30 years ago in 54-year-old pure stands in the Willamette National Forest.

6. MANAGEMENT. WORKING PLANS. SURVEYS

61. SURVEYING. MAPPING. PHOTOGRAPHY

61. EHRHART, E. O. **The use of aerial photography in forest management.** *Pennsylvania Department of Forests and Waters Service Letter* 10, 1939 (35–9, 47). [Armstrong Forest Company, Johnsonburg, Pa.]

61 : 52.4. DUBUAR, J. F. **Use of square plots in place of circular plots in timber**

estimating. *J. For.* 38, 1940 (514–5). [State Ranger School, Wanakena, N.Y.]

A square plot laid out diagonally on the cruise line can be established and tallied in reasonable time, and will not have the disadvantages of a circular plot, particularly as to the uncertainty of trees to be tallied. Fifth-acre square plots have the added advantage of a half diagonal length of exactly one chain.

63. ROTATION

63 : 74. KEARNS, R. S. **Rotations.** *J. For.* 38, 1940 (339–40). [Oregon State College.]

Under the management system of clear cutting and planting, with financial returns as the objective, rotation will be determined on forest rent or soil rent principles. These are shown to be similar, the length of rotation varying with the character of the area to which it is applied rather than with the method of its determination.

65. DESCRIPTION OF GROWING STOCK

65–6 : 12.2. GEVORKIANTZ, S. R. **Comments on 'The approach of Loblolly and Virginia Pine stands toward normal stocking'.** *J. For.* 38, 1940 (512–3). [Lake States Forest Exp. Sta.]

A critical analysis of the method suggested by Chaiken [Cf. *For. Abs.* 1 (301)] for estimating the rate of approach towards normality of abnormally stocked stands. The author gives support to Gehrhardt's method, which had been criticized in the original article.

65 : 01. CHISMAN, H. H., and SCHUMACHER, F. X. **On the tree-area ratio and certain of its applications.** *J. For.* 38, 1940 (311–7). [Duke School of Forestry.]

A method is developed of allocating tree area according to d.b.h. of individual trees by means of a quadratic equation fitted by the method of least squares to sample plot data. Plot data in number of trees, sum of diameters, and sum of squared diameters are expressed on the unit-area bases. The calculated equation is then an expression of density of stocking as a proportion of the average density of stocking represented by the data. Consequently if the data represent fully stocked plots, the equation supplies a stocking norm for the timber type, or condition, upon which it is founded. Two examples illustrate the method, one from an uneven-aged, mixed, upland hardwood stand in the Piedmont Plateau, and the second a normal even-aged Loblolly Pine stand. *From authors' summary.*

65 : 52.4 : 12.2 (79.5 : 79.7). BRIEGLEB, P. A., and DUNFORD, E. G. **Volume distribution in saw-timber types in the Ponderosa Pine region.** *For. Res. Note Pacif. Nthwest. For. & Range Exp. Sta.* No. 28, 1939. pp. 15.

The total area of this region in eastern Washington and Oregon occupied by saw-timber types is about 13·5 million acreas, containing 127 billion bd. ft. of saw timber, of which 64 per cent. is Ponderosa Pine (*Pinus ponderosa*). Survey data are analysed to show (*a*) volume of saw timber by forest-survey unit and ownership class, (*b*) average stand per acre by geographic units for various saw-timber types, (*c*) volume distribution by diameter class in important old-growth Ponderosa Pine types, and (*d*) volume in residual stands on selectively cut-over areas. The management system recently formulated for this type is the 'maturity selection system' by which the economically and silviculturally most mature trees, still of good value, are removed, resulting in an average initial cut of from 25 to 50 per cent. of the original stand volume.

66. POSSIBILITY. YIELD REGULATION

66. SIMMONS, F. C. **Does total growth equal allowable annual cut?** *J. For.* 38, 1940 (409–12). [U.S. Forest Service.]

It is pointed out that, when only a small portion of a stand is operable and the remainder is of younger age classes that will not be economically operable for some time, or when the stand consists only of thrifty growing trees, the owner cannot cut each year an amount equal to the current annual increment before cutting, and still maintain that increment. It has been shown in the Northeast and Lake States that the allowable cut can be increased three to five times by using a system of partial cutting rather than clear cutting, the trees selected for removal being those static in growth or of negative increment. In thrifty stands the allowable cut must be below current growth in order to attain sustained yield. A method is described for planning the allowable cut and determining the potentially merchantable trees in sample stands.

90. GENERAL PRINCIPLES OF FOREST POLICY

90 : 81. BRINSLEY, G. G. **Establishment of forestry departments in colonies.** *Emp. For. J.* 19, 1940 (87–90).

A statement of the problems of initial work, staffing, organization, and public relations in a newly established colonial forestry department, as distinct from the problems of a forest service of long standing. It is suggested that the creation of such departments demands a staff of specialists, who on completing their work should leave any colony in such a condition that an ordinary forest officer could carry on adequately.

90 (47.2–6). ZDORIK, M. G. **The fundamental organization problems of Socialist forestry.** *Lesnoe Khozyaystvo, Moscow* 1940 (5), (8–15). [R.]

In industrial forests, as opposed to those of local importance, protection forests, etc., the present tendency is to subordinate the principle of sustained yield as applied to individual forests and forest regions, to the satisfaction of the timber requirements of the State and the industrialization of exploitation methods. In the author's opinion, this tendency is fully justified and should be made the basis of official instructions for the preparation of working plans in industrial forests which, it is estimated, make up 79·2 per cent. of the total forest resources of the country.

90 : 09.1 : 07 (54). CHAMPION, H. G. **Progress of forestry in India during the past twenty-five years.** *Repr.* from '*Progress of science in India during the past twenty-five years*'. Indian Science Congress Association, 1, Park Street, Calcutta. 1938. pp. 434–56.

91. BENEFICIAL EFFECTS AND ECONOMIC SIGNIFICANCE

91 (74.1–6). **Forests and recreational policies in New England.** Report of Committee on Forest Policy, New England Section. *J. For.* 38, 1940 (397–400).

92. FOREST LAW

92 : 05.4. Annuaire international de législation agricole. XXIXème année—1939. **[International yearbook of agricultural legislation. 29th year—1939.]** Institut International d'Agriculture, Rome. 1940. pp. 965. [F.]

Part IV, Chapter IV (pp. 384–93) deals with forest legislation. Laws, enactments, and decrees referring to forestry and enacted in the course of 1939 are listed by country. The Norwegian Law No. 17 of June 9, 1939, concerning forests the produce of which is intended for domestic consumption (husbruksskoger), is given in full. 'Husbruksskoger' are understood to be all forests belonging to farmers' associations and acquired for the purpose of safeguarding the supply of farm timber. The Law forbids the sale, division, or mortgage of such woods and provides for Government supervision, working-plan obligation, and expert management.

92 (77.6). MINNESOTA, U.S.A. **State of Minnesota Forest Laws.** Division of Forestry, Department of Conservation, Minnesota. 1938.

94. OWNERSHIP, ACQUISITION AND ALIENATION

94.3 : 32.6 (71). WILSON, E. **Private forestry in Canada.** *Emp. For. J.* 19, 1940 (19–33).

In both private and commercial forests of Canada the practice of forestry is very backward, and there seems to have been too little encouragement for good silviculture on the part of the owners. Details are given of some forests, notably the Seigniory of Perthuis, Quebec, and forests formerly owned by the Laurentide Co. of Grand Mère, Quebec, where silviculture and management have been practised with success. There are good prospects for better management in the future, but it will be long before management is widely enough practised.

94.3 : 90 (74.8–75.2). **Report of the Committee on Private Forestry, Allegheny Section, Society of American Foresters.** *J. For.* 38, 1940 (477–80).

It is pointed out that in private forestry the cost of the product must not be increased over current market values, and so factors favourable to low production cost must be emphasized. These include (*a*) selection of areas that will produce high-quality timber quickly, (*b*) protection only for non-paying forest areas, (*c*) ease of accessibility to all parts of selected areas, (*d*) development of mechanized methods that will help lower production costs. It is suggested that management plans should be

simple, and that the selection and training of the best woodsmen for year-around employment would be an important contribution to good forest practice.

94.3 : 97.1 (410). THOMPSON, C. H. **The private woodland owner's approach to a national land policy.** *Quart. J. For.* 34, 1940 (98–107).

The past and present position of private woodlands in Britain is reviewed. Suggestions of policy for the future include extension of financial grants by the Government associated with some measure of State control, extension of co-operative management and marketing, development of facilities for professional training, and the creation of an advisory service.

95. FOREST TAXATION. FOREST LOANS

95 : 65 (73). BIRD, R. G. **Forest taxes and adequate growing stock.** *J. For.* 38, 1940 (487–90).

It is concluded that in second-growth pulpwood stands in the Adirondacks the annual property tax paid per cord of current growth is much higher for depleted stands with a growing stock of less than five or six cords per acre than for well stocked stands. Control of logging operations by marking and inspection can be financed by saving in taxes alone, if the growing stock is not reduced below this minimum.

95 : 66 : 22.1 (71). MULLOY, G. A. **Timber dues as a means of silvicultural control of cutting.** *For. Chron.* 16, 1940 (128–31). [Dominion Forest Service, Ottawa.]

Where cutting control is by minimum diameter limit only, it is suggested that a further safeguard to the silvicultural and economic future of high-grade lumber stands may be effected by applying a sliding rate of dues that would favour the selection, by the operator, of trees of large diameter, leaving the smaller trees that are almost marginal in yield value. The sliding rate would be applied within limits of the set minimum diameter and an upper limit beyond which no decrease in dues would be allowed. It is proposed that the rate of dues be based on the straight average diameter of the stumps left after cutting, which would be determined by a strip stump-diameter tally of the area cut.

97. RELATION OF FOREST TO AGRICULTURE, MOUNTAIN PASTURE, AND INDUSTRY

97 (73). YOUNG, V. A. **The rôle of range management in forestry.** *J. For.* 38, 1940 (383–5). [School of Forestry, University of Idaho.]

97.1 (213). BEARD, J. S. **Forestry and land planning in the Tropics.** *Emp. For. J.* 19, 1940 (69–73).

A plea is made that forest officers in the colonies should devote more attention to the planning of land utilization, based on soil and ecological surveys. It is endeavoured to show, by reference to Trinidad, how many mistakes in land use occurred in the past, leading to wastage of forest capital and soil fertility, and how the planning of land is now being carried on under a Lands Advisory Committee, how ecological and soil surveys have been carried out, and how pure forestry itself benefits from these. *Author's summary.*

97.1 : 11.4 (71.3–7). STOBBE, P. C. **Land classification.** *For. Chron.* 16, 1940 (119–25). [Federal Department of Agriculture.]

A general discussion of the factors contributing to the development of the acid and leached soils known as podsols, and of the characteristics of these soils as determined from results so far obtained by a soil survey of New Brunswick. The soil groups that have been encountered in the survey so far are: (1) Soils of the Pre-Carboniferous schists and shales, which have a relatively high natural fertility, and, when well-drained, will bear a tree cover consisting chiefly of the Maple/Yellow Birch/Beech association. (2) Soils on the Upper Carboniferous or Pennsylvanian formation, which have a low natural fertility. On well-drained soils of this group the natural vegetation is a mixed deciduous/coniferous tree cover ranging to a dominantly coniferous cover on the poorly drained soils. (3) Soils on the Lower-Carboniferous or Mississippian formation, which have a natural fertility similar to (2) although these two soils differ in appearance. (4) The water-deposited soils along river valleys, streams and sea shores, the most fertile of which are subjected to periodic flooding.

97.2 (73). UNITED STATES. **Forestry in relation to agriculture.** Papers delivered before the Forestry Section of the Association

of Southern Agricultural Workers, New Orleans, Louisiana, February 1, 2 and 3, 1939. U.S. Forest Service, Southern Region, Atlanta, Georgia. 1939 [?]. pp. 38.

97.2 (73). BRUNER, M. H. **Another approach to farm forestry.** *J. For.* 38, 1940 (307–10). [Clemson College Extension Service.]

97.2 : 35 : 32.6 (73). **Farm forest co-operatives help to solve timber growing and marketing problems.** U.S. Forest Service, Washington, D.C. 1939. pp. 48.

Information on several co-operative marketing projects as submitted by representatives of State Extension Services, the West Virginia Agricultural Experiment Station, and the U.S. Forest Service. In the last five years interest in co-operative farm timber marketing has grown rapidly but the movement is still in the experimental stage.

97.2 : 72. OLSON, G. T. **How much does the farmer make from his timber sales?** *J. For.* 38, 1940 (504–8). [Forestry Relations Department, Tennessee Valley Authority.]

The operation of the farm woodland should be looked upon as a supplementary enterprise to the entire farm business and not as a separate undertaking. The cost and returns from the woodland should be considered only as they affect the net farm income. Certain economic principles, which enter into the computation of farm woodland production costs, are described.

97.2 : 92 : 90 (73). WILCOX, R. F. **Intensive forestry projects under the provisions of the Co-operative Farm Forestry Act.** *J. For.* 38, 1940 (457–64). [Soil Conservation Service.]

BOOKS

42.3 : 11.6. BENNETT, H. H. **Soil conservation.** McGraw-Hill Publishing Co., Ltd., London. 1939. pp. 993.

This book, by the Chief of the United States Soil Conservation Service, is the largest yet published on the subject of its title. Except for a short introductory chapter on the history of soil erosion and a later chapter of 40 pages on 'erosion problems in foreign countries' the whole of the thousand-odd pages is devoted to conditions in the United States. Nevertheless there is little that is redundant in the book, or that people in other parts of the world confronted with the modern problems of soil conservation cannot read and digest with advantage. The basic cause of soil erosion is the same everywhere—inappropriate land utilization—but the cure varies greatly according to the environment, and it should not be assumed that because America has evolved sound methods of soil conservation those same methods are necessarily applicable elsewhere.

The first part of the book is concerned mainly with the physical factors influencing the onset of erosion, and the second and longer part with the measures which have been taken to counteract these factors, starting with simple mechanical devices for preventing water from running off sloping fields, and gradually evolving towards an entirely new national economy planned for the same purpose. The approach to the problem is definitely agricultural, and the forester may feel that the few pages devoted to the place of forestry in soil conservation are not proportionate to the importance of forests. Soil conservation, however, is essentially a matter of substituting for the natural vegetation a human control of land that is as efficient as the natural vegetation in preserving the fertility and stability of the soil. This at least appears to be Dr. Bennett's view, and soil conservation is considered to be primarily the job of the agriculturist when he supersedes the forester.

The book is excellently arranged and very clearly written. It contains all the facts necessary for a proper understanding of the present revolution in American agriculture. Over 350 vivid illustrations give the story of soil erosion and conservation for those who may at first hesitate before embarking upon the text. But the text well repays a detailed study.

G. V. JACKS.

12.19 : 13.1 (73). CLEMENTS, F. E., and SHELFORD, V. E. **Bio-ecology.** John Wiley & Sons, Inc., New York. Chapman & Hall, Ltd., London. 1939. pp. 6 + 425.

The term bio-ecology is synonymous with ecology in the sense in which it should always be understood, that is, the study of the living organisms which are typical of any particular habitat or dwelling-place, of their relationship to each other, of the influence of the habitat on them, and conversely of their influence on the habitat. Naturally, such a study covers a very wide field; far too wide, in fact, for any one person to carry out intensive work over the whole of it adequately or with success. The divisions in the study of ecology are largely due to this physical impossibility of working on more than one section of the subject and, surely, responsible ecologists have always recognized this. In the work under review the authors have attempted to write a textbook on ecology in which the wide fundamental basis of the subject is fully recognized. The geographical area covered is the North American continent with special reference to the United States. They have succeeded in producing an interesting and valuable book in which the principles of ecology are well illustrated. The book falls into two sections. The first seven chapters discuss the development of the community in relation to habitat and are largely concerned with general principles and definite statements. The last three chapters are concerned with the North American grassland; aquatic climax communities; and marine biotic communities respectively. There is a short appendix dealing with methods of procedure with reference to the investigation of animals. A bibliography of literature references is given and also an index. The book is well printed and the illustrations are good, as a whole.

This work is to be regarded as a general introductory textbook on ecology for the advanced student who has not, or perhaps should not, yet have begun to specialize on any particular aspect of the subject. Its real value lies in its statement of principles. The ground covered is so wide that readers will often find more adequate discussions of individual subjects in other works. It is difficult to cover so wide a field without often becoming rather

abstruse and the authors have not failed to do this. They have, according to the preface, made an attempt to avoid some of the more technical terms but, even so, the reader may easily finish the book with his mind so tired and confused by the rich variety of such terms that he may have absorbed only too inadequately the true doctrine which it was intended to convey to him. The omission of a glossary makes this particularly possible and there is really no excuse for such an omission in a book of this nature.

Ecology, rightly understood, is so important a subject and is concerned so closely with every one's interest, that it should be discussed in the simplest possible language. Its main difficulty to the well-educated person who has had an elementary introduction to biology lies in its complexity and this should be overcome by clear and careful thought and statement. Books written in the style of much of this one tend to create an ecological priesthood who only are able to understand the mysteries and this is exactly what should not be. There would seem to be no need so to confuse a valuable book such as the one here reviewed.

W. R. DAY.

45.3 : 34.25. HOLMAN, H. J. [Editor]. **A survey of insecticide materials of vegetable origin.** Imperial Institute, London. 1940. pp. 155.

This bulletin provides the most comprehensive account published in this country, so far, of those materials of vegetable origin which are of value for insecticide purposes. It is divided into five main sections which comprise (1) Alkaloid-containing materials such as, Nicotine, Anabasine, Hellebore, and miscellaneous alkaloids having insecticidal action; (2) Plants containing rotenone and allied compounds; (3) Pyrethrum; (4) Quassia; and (5) Plant oils.

The most complete and up-to-date information has been collected with great skill and thoroughness in all sections of the work. The chemical nature, derivatives, and methods of preparation of the substances concerned, the botany and geographical distribution of the plants from which they are obtained, the statistics of world production, where available, over the past few years, will all be found in its pages. In addition, there is a full bibliography to complete the text.

The bulletin will remain a standard work of reference for a long time to come. The entomologist will be grateful to the Institute for its preparation, and apart from the main text, he will find valuable references in the bibliography to recent entomological research upon the insecticidal action of the substances concerned.

R. N. CHRYSTAL.

23.26.3 : 23.27. KOLESNIKOV, A. I. **The transplanting of big trees.** Vsesoyuznaya Akademiya Sel'skokhozyaystvennȳkh Nauk im. V. I. Lenina. [All-Union (Lenin) Academy of Agricultural Sciences], Moscow. 1939. pp. 79. [R.]

This subject is dealt with under the following chapter headings: Foreign and Russian data on the transplanting of big trees; tolerance of the different tree species; best time of year; methods of transplanting big trees; transplanting trees with frozen earth-ball round the roots; transplanting without an earth-ball; preparation for transplanting; subsequent treatment of fully grown trees; transplanting big palm trees; transplanting big fruit trees. Drawings and specifications are given for an iron transplanting frame designed by the author.

22.21. TANASESCU, N. Contributions à l'étude botanique et forestière des taillis sous futaie. **[Contributions to the study of the botany and forestry of coppice with standards.]** Société d'Impressions Typographiques, Nancy. 1939. pp. 211. [F.]

NOTES FROM ANNUAL REPORTS

Reports examined include: *Australia:* Thirteenth annual report of the Council for Scientific and Industrial Research, for year 1938–39. *British Columbia:* Report of the Forest Branch for the year ended 31st December, 1939. *British Honduras:* Report of the Forest Department for the year 1939. *Burma:* Annual report on working plans, silviculture and entomology for the year 1938–39. *Canada:* Report of the Lands, Parks and Forests Branch for the fiscal year ended 31st March, 1939. *Madras:* Annual report on silvicultural research for the year 1938–39. *New Brunswick:* 103rd annual report of the Department of Lands and Mines for the year ended 31st October, 1939. *New South Wales:* Report of the Forestry Commission for the year ended 30th June, 1939. *New York:* Twenty-ninth annual report of the Conservation Department for the year 1939. *Northern Rhodesia:* Annual report of the Department of Agriculture for the year 1939. *Nyasaland:* Annual report of the Forestry Department for the year ended 31st December, 1939. *Orissa:* Annual progress report on forest administration for the year 1938–39. *South Carolina:* Report of the State Commission of Forestry for the year 1st July, 1938 to 30th June, 1939. *Uganda:* Annual report of the Forest Department for the year ended 31st December, 1939. *United States* (1): Annual report of the Allegheny Forest Experiment Station, 1939. *United States* (2): Nineteenth annual report and program of the Appalachian Forest Experiment Station, 1939–40. *United States* (3): Annual report of the Intermountain Forest and Range Experiment Station for 1939. *United States* (4): Report of the Rocky Mountain Forest and Range Experiment Station for the calendar year 1939. *Vermont:* Fifty-second annual report of the Vermont Agricultural Experiment Station, 1938–39. *Wisconsin:* Annual report of the Director, Agricultural Experiment Station, University of Wisconsin, 1939.

The numbers in brackets indicate the pages of the reports to which the annotations refer.

GENERAL FORESTRY

Canada. The timber stand of merchantable size that is accessible under present conditions is estimated at 170,144 million cu. ft. Softwoods comprise 78 per cent. of the merchantable timber in the country (129).

New South Wales. National and State Forests and Timber Reserves have a total area of 6,528,821 acres (7).

United States (3). The commercially important forests of the Intermountain region occupy 16 million acres, including 4 million acres of Lodgepole Pine (*Pinus contorta*) (6).

FOREST INFLUENCES

United States (2). The comparison of coincident weather records from two contiguous areas, which differ only in the presence or absence of forest, showed that: (1) The average daily temperatures dropped 3° or 4° F. lower in forest than in denuded zone both in winter and summer. (2) Average wind velocity was 7 to 10 times as great in the denuded zone in winter, and 34 to 40 times as great in summer. (3) Evaporation was twice as great in the denuded zone in winter and 7 times as great in summer. (4) Precipitation has been consistently higher in the forest than in the denuded zone (14).

United States (4). Measurements show that one-third of the summer rainfall is intercepted by the Lodgepole Pine canopy, and observations indicate that the amount of water stored in the snow varies inversely with the density of such a canopy (18–9).

SILVICULTURE

British Columbia. Observations indicate that an average of 1·3 to 3·5 Douglas Fir seed trees per acre are sufficient for re-stocking an area after logging and slash burning, despite the destruction of 86 to 98 per cent. of the seed by mice, birds and other causes. Soil temperature appears to be an important factor affecting the germination of Douglas Fir seed, whereas light is relatively unimportant (E17).

British Honduras. Cohune Palm (*Orbignya cohune*) was found to be a serious competitor of Mahogany in the advanced forest in which mortality of the latter species averaged almost 57 per cent. between 1926 and 1939, while mortality in the intermediate forest was only about 14 per cent. for the same period (3).

Burma. Frill girdling and sodium-arsenite poisoning of the larger trees round Teak seed-bearers, as an aid to natural regeneration, is found to be less costly than felling, but the degree of success is as yet uncertain (48–9). The use of sugar cane as a *taungya* crop saves weeding, but the leaf litter gives rise to serious fire danger, the crop is so thick that blanks are hidden, and production of this crop already exceeds demand (49–50). Pyinkado (*Xylia dolabriformis*) seed stored for up to 2 or 3 years in sealed tins gave fair germination (53). The spacing of Cutch (*Acacia catechu*) at 9 × 9 ft. appears to give better results than at 6 × 6 ft. (58). In Möng Mit climbers form a dense mat in the tree crowns, and both deform the crowns and exclude light from the forest floor: this prevents regeneration of many light-demanders and favours evergreens, and may be one cause of the change of large areas of deciduous into evergreen forests (62).

Madras. *Cassia siamea* and Bamboos are useful for restocking areas cleared of Lantana: they are good hosts for Sandal and are profitable in themselves (2). Opening the canopy proved beneficial to young regeneration of *Hopea parviflora*, *Palaquium ellipticum*, and *Pterocarpus santalinus*, but not to that of *Mesua ferrea* (4–7). Mortality in coppice stools of *Acacia sundra*, *Albizzia amara*, and *Azadirachta indica* was high, emphasizing the need for supplementary regeneration in coppice fuel forests (7). *Hopea* seed should be sown on its side and well covered (11). Germination of *Azadirachta indica* seed is greatly improved by removing the pulp. Covering the seedbed with straw increased the germination of *Gluta travancorica* (12). For most dry-district species germination was not affected by shading the seed patches (17). Shade and shelter improved germination of *Artocarpus hirsuta* and reduced mortality in seedlings of *Hopea parviflora*, *Dysoxylum malabaricum*, and *Cedrela toona* (17–8). Seedlings of *Azadirachta indica*, *Acacia planifrons*, and *Prosopis juliflora* needed much less watering than those of *Albizzia amara*, though watering had no effect on the germination of these species. Teak seed should be sown evenly at about 20–30 lb. per standard 40 × 40 ft. nursery bed, and there should be no pricking out of seedlings; in this way adequate stump plants will be produced with most economy in seed and cost (21–2). Stump planting is the best method of artificial regeneration for *Pterocarpus marsupium* and probably for *Terminalia paniculata*, *Schleichera trijuga*, *Lagerstroemia lanceolata*, and *L. flos-reginae*; transplanting is likely to be best for *Trema orientalis*, and direct sowing for *Artocarpus integrifolia* (27–31). Teak stumps dug up after sprouting in the nursery and stored in bundles in a well ventilated room will keep for 2–3 weeks without deterioration (42–3). In spite of the high initial costs an irrigated Teak plantation raised on what was formerly scrub fuel forest has shown a high profit. Irrigation by percolation is cheaper and more efficient than flooding (45–6). Transplanting seems to be the best method of raising *Swietenia macrophylla* and transplants 18–36 in. high have given the best survival (47). Direct sowing is best for most species used to regenerate dry fuel forests; early sowings have proved advantageous, and failures can be re-sown if necessary (65). *Cassia auriculata* can be raised without a burn provided the soil is worked intensively, which, together with weeding, greatly reduces mortality and improves height growth (66). Large, deeply planted cuttings of *Poinciana elata* give the best results in the establishment of this species for manure-leaf plantations (67–9). Sandal can be successfully regenerated by stump planting, and the stumps can be stored in tins for 3 weeks without serious loss (70). Sodium-chlorate spraying of Lantana is the cheapest and most efficient method of eradication, costing about Rs. 10 per acre (121).

New York. Two-year seedlings of Red and Scots Pine, grown at a reduced seedbed density, have been found just as satisfactory as older and more expensive transplants (60, 71). A relatively cheap method of thinning a 4 × 4 ft. White Pine plantation is the removal of every third row, and this appears to be the best practical method of admitting light, air and hardwoods into a closed, softwood stand with the object of preventing an accumulation of undecomposed needle litter, a condition known to be detrimental to plantation development (65). Results from an investigation on pruning show that: (*a*) For Scots Pine the rate of complete callousing increases with rate of growth, age and variety of trees being the same. (*b*) The first pruning should be made soon after the stand closes. (*c*) Branches should be pruned before they are completely dead. (*d*) The pruning cut should be made parallel to the trunk, through the outer part of the branch base using a sharp saw having not less than 9 teeth per inch (115).

Northern Rhodesia. According to recent agreement the *Baikiaea* forests in the Sesheke District of the Southern Division are to be cut under certain silvicultural regulations, *e.g.* (1) a minimum girth limit of 47 in. d.b.h., (2) the marking of seed trees, irrespective of girth, in poorly stocked

forests, (3) slash disposal, and (4) levying of damages on operators who cause damage to pole growth (15). In *Brachystegia–Isoberlinia* woodlands of the Northern Division that are clear-cut for firewood, slash disposal and early burning are the only measures usually found necessary for satisfactory natural regeneration, which is usually of coppice or sucker origin (16). The average height of indigenous species, established experimentally in spot sowing six years previously, was found to be 15 ft. for *Albizzia gummifera*, 10 ft. for *Erythrophleum africanum* and 5 ft. for *Afzelia quanzensis*. Of the exotic Pines recently tested, *P. leiophylla* shows the best development. A plot of *P. patula* has reached an average height of 12 ft. in 3 years. The species *P. canariensis*, *P. halepensis*, *P. pinaster*, and *P. pinea* have been found unsuited to local conditions (17).

Nyasaland. Comparison of the growth of *Cupressus lusitanica* in Nyasaland with data on Pine in South Africa show that the best growth of the former species is only up to that of the relatively slow-growing *Pinus pinaster* on the best sites (5). The severe pruning of *C. lusitanica* usually causes a setback in height growth for two or three years (6). Tapping of the Palm *Hyphaene crinita*, even when carefully done, makes the tree very liable to attack by the rhinoceros beetle (*Oryctes* sp.) (9). Coppice shoots of *Brachystegia* spp. show a considerably higher growth rate than do those of Msuku (*Uapaca kirkiana*) and Chinsense (*Faurea* spp.) (10).

Orissa. Repeated cleanings have aided Sal regeneration (10). The sowing of Teak seed in drills 9 in. apart in May, followed by thinning of the seedlings instead of pricking out, is reported to have given better results than sowing in April and pricking out in May–June (24).

South Carolina. Under the system of woods operation advocated by the State Forest Service, the amount of timber removed periodically from a woodlot should not exceed the yield for the period of time since the previous harvest, and each tree to be cut is selected, marked, and its most suitable product designated (36).

Uganda. In planting Mahogany (*Khaya*) and Mvule (*Chlorophora excelsa*) only large, stripped plants, at least 4 ft. high, are to be used as these have proved so successful in the past (12). Artificial rather than natural shade is required by *Entandrophragma utile* in nurseries, although high natural cover is used successfully for other species. In an experimental planting *Chlorophora excelsa* grew better from stem cuttings than from stumps, but if the latter are used they give better results when planted in large pits rather than small holes (14).

United States (1). In the Oak-Pine type in New Jersey, where both fire protection and frequent burning favour Oak regeneration, it has been found that Pine seedlings become established after the turfy layer on the soil is either burned off or dug up by mechanical means (6). Surveys of past plantations show that the best results have been obtained on abandoned farmland, and poorest results on land occupied by woody and herbaceous species, which overtop the planted trees. Of the species planted, Red Pine appears to have given best results (10). Exposure of seed of Red and Ponderosa Pine to formalin vapour killed surface-borne fungi and thus protected the seedlings against these organisms. Seedlings grown at low pH (3·5) become more resistant to damping-off than those grown at high pH (5·5) (11).

United States (2). Epicormic branches ('water sprouts') developed on a number of second-growth hardwoods following release cutting. These species, in descending order of epicormic branching, are as follows: White Oak (100 per cent. of trees), Cucumber, Hickory, Yellow Poplar, Northern Red Oak, and White Ash. Beech was the only species that did not react in this way (6–7). Analysis of first-year survivals, following planting experiments, showed that for the three soil types and two aspects tested, dolomite north and south slopes and limestone north slopes were best, limestone south and shale north slopes intermediate, and shale south slopes worst; Shortleaf Pine, Yellow Poplar, and White Pine were best on dolomite and limestone south slopes and poorest on shale south slopes (8). Experimental plantings of 20 species of conifers, including 16 exotics, on the Spruce lands of the Southern Appalachians where conditions are severe, showed that the native Balsam Fir (*Abies fraseri*) gave best results, followed by Red Spruce, Norway Spruce and Red Pine (9). First-year results from experiments in direct seeding in the Piedmont region show that (1) fall seeding is superior to spring seeding, (2) the most important cause of seed mortality is drought, (3) screens aid survival by shading and protection against rodents, and (4) the effects of ground treatments such as mulching and scarification vary for different site conditions (10–11).

United States (4). The establishment and growth of vigorous natural regeneration of Lodgepole Pine requires a stand crown density of 40 per cent. or less, while Spruce and Fir will regenerate

under greater densities (4). Grading of the planting stock of Ponderosa Pine, Douglas Fir, Engelmann Spruce and Lodgepole Pine has been proved of value in relation to transplant survival (7).

Vermont. A new method has been devised for determining CO_2 content. This method gives continuous readings and is sensitive to changes of 0·0001 per cent. at 0·03 per cent. concentration (22).

Wisconsin. In general, the productive ratio of available nitrogen, phosphoric acid, and potash should be about 1 : 2 : 5 for Jack Pine, Red Pine, White Pine and White Spruce (56). Seedlings and transplants may yellow and stop growing by midsummer following the leaching from the soils of easily soluble salts by heavy rainfall and by heavy feeding of seedlings during the spring. A practical remedy is the application of nutrients dissolved in water. The use of raw peat and organic matter as fertilizer will cause bacteria to multiply rapidly with a consequent reduction in available nitrogen. Applications of nitrate or ammonium salts will remedy this condition. Shallow applications of organic matter fertilizer will result in the seedling developing a mat of surface roots which do not penetrate the soil to a sufficient depth to obtain nutrients such as phosphate and potash (56–7). Where complete fertilizers are broadcast before planting the area should be cultivated to keep weeds in check (58).

EXTRACTION, UTILIZATION, AND MARKETING

Australia. A method that has been found satisfactory for obtaining free fibres from radial sections of dicotyledonous wood is (*a*) pre-treatment with boiling 0·053–0·08 per cent. sodium hydroxide, (*b*) chlorination with chlorine water, and (*c*) an alkaline wash with 0·08 per cent. sodium hydroxide stirred quickly for a short time at room temperature (53). Thiobarbituric acid has been found more satisfactory than phloroglucinol as the precipitant for furfural when working with hardwoods, and equally satisfactory with softwoods if care is taken to wash out the water-soluble condensation product of thiobarbituric acid and formaldehyde (54). Varying results in the determination of Cross and Bevan cellulose were found to be due to the use of relatively coarse alundum crucibles (R.A.98). Finer crucibles (R.A.360) have proved satisfactory when chlorine water is used as the chlorinating medium (54). Tests of the steam-bending qualities of Australian timbers showed that none of them were as satisfactory as imported Ash (*Fraxinus* spp.) although the following species gave good results—Spur Mahogany (*Dysoxylum pettigrewianum*), Celery Top Pine (*Phyllocladus rhomboidalis*), Myrtle Beech (*Nothofagus cunninghamii*), Southern Sassafras, Red Tulip Oak (*Tarrietia argyrodendron* var. *peralata*), Radiata Pine, Corsican Pine, Horizontal (*Anodopetalum biglandulosum*), and Northern Silky Oak (*Cardwellia sublimis*) (55). Tests of split-ring connectors indicate that when the load is applied parallel to the grain the strength of the joint is somewhat higher for dry specimens than for green ones, whereas the opposite was found to be true when the load was applied perpendicular to the grain. Tests were made on specimens of green Ironbark (*Eucalyptus sieberiana*), and Jarrah (*E. marginata*), and Karri (*E. diversicolor*) dried to 18 per cent. moisture content. Preliminary examinations show that the following treatments give the best protection to connectors against corrosion caused by wood acids and moisture:—galvanizing, aluminium paste in long oil varnish, Parkering, zinc dust in boiled linseed oil, and coke-oven pitch and coal tar (56). It seems probable that chlorinated naphthalenes will be of practical value in the treatment of manufactured building materials against termites, and that their value in this regard increases with the number of substituted chlorine atoms (21). Small poles of *Eucalyptus obliqua* are protected against termite and decay for at least two years by brushing creosote oil over the sapwood plus puddling the soil with half a gallon of creosote (57). The treatment of Class 1 durability poles, which have become partly decayed while in use, by the oxy-acetylene scouring and charring process will prevent re-infection for a period of at least three years without the need of re-spraying with creosote oil. Sapwood can be made immune to *Lyctus* attack by application of boric acid at a concentration of 0·12 per cent. based on the oven-dry weight of the wood (58).

British Columbia. The total timber scale for the year, including sawlogs and minor products was 3,354,895,566 bd. ft. (E7).

British Honduras. Export of Mahogany and Cedar logs totalled 512,052 cu. ft. and shipments of Mahogany and Cedar lumber totalled 201,941 cu. ft. (6).

Canada. Hemlock ties originally treated with an average of ½ lb. of zinc chloride per cu. ft. showed only a small percentage of preservative remaining after 9 years in service and decay was found progressing under the railseat. Tests have shown that creosote completely penetrates the sapwood of Red Pine poles when treated at 20 per cent. moisture content though not at 30 per cent.

moisture, and that steaming reduces checking in the heartwood (148). The presence of lubricants on the surface of small clear test specimens reduces the recorded hardness of wood subjected to the ball test (149). A cold-press resin glue used on Hard Maple showed strength value equal to that of the wood and when used with Douglas Fir three-ply, and tested in shear, it gave results equal to those obtained with casein or soya-bean glues (163). Mill-waste sawdust containing a high proportion of bark-covered sapwood showed a moisture content higher than normal and a calorific value slightly greater, and was found to be a satisfactory fuel (165). Tests of the comparative efficiency of gasoline and producer gas used in a stationary gasoline engine indicated that an over-powered engine should be used to obtain satisfactory performance under heavy load when using charcoal producer gas (166).

New South Wales. A cheap and practical type of portable collapsible hutment has been developed for the accommodation of men in road and construction camps. The component parts are of standard pattern, interchangeable, light in weight and easily handled (6).

Nyasaland. The total production for the year, under licence and control, was 177,000 cu. ft. of timber and 957,000 cu. ft. of firewood (12, 20). The attack by boring insects on recently sawn boards of *Brachystegia* spp. was prevented temporarily by painting with a solution of sodium arsenite (12).

South Carolina. Thirty-three per cent. of all the sound wood taken from the forests is used for fuel while 13 per cent. is being used in pulp mills (13–4).

PROTECTION

Australia. Symptoms of needle fusion in *Pinus taeda* and *P. caribaea* were reduced or completely absent during the first season after treatment with borax, although there was little increase in vegetative vigour of the trees responding to the treatment. No correlation could be established between amount of needle fusion and the acid-soluble P_2O_5 content of soils or the loss on ignition. There is some evidence that individual Pines may be genetically more susceptible to the disease than others (15).

British Columbia. Of the factors affecting the origin and behaviour of fires, fuel moisture has been found to have the closest relationship to inflammability (E19).

British Honduras. Pine (*Pinus caribaea*) trees weakened by drought were attacked by scolytid beetles, resulting in considerable mortality. The breaking of the rains effectively controlled this damage (3). Cashew (*Anacardium occidentale*) was successfully established along fire lines with the object of shading out the grass and stopping the passage of burning debris and so replacing the open fire lines which require costly annual burning (4).

Burma. Detailed progress results are given of research on pests of Teak, Pyinkado, and other economic species, including records of natural enemies of the pests (94–105).

New Brunswick. Three factors have contributed to progress in the control of the European Spruce sawfly, particularly in southern New Brunswick. (1) The rapid increase and effectiveness of the imported cocoon parasite *Microplectron fuscipennis* and larval parasite *Exenterus adspersus*. (2) A virus disease of the larvae. (3) Weather conditions unfavourable for the insect (15, 135–6). An imported parasite (*Mesoleius tenthredinia*) is contributing to the control of the Larch sawfly (*Pristiphora erichsoni*) (138). A general fire-hazard Danger Index scale has been prepared for use throughout the province. It shows the daily average degree of inflammability of forested areas, also taking into consideration visibility conditions and fire-starting agencies (139).

New York. A study of blister-rust infection in natural stands and plantations of White Pine indicated that: (1) 12- to 20-year stands uniformly stocked with 2,000 Pine or more per acre are relatively safe from damage of commercial significance. (2) Under average swamp or dense woodland conditions the protective border (freed from *Ribes*) may be left much narrower than in open land types (114).

Northern Rhodesia. Hoeing of narrow tracks on each side of the fire breaks and burning the enclosed grass when thoroughly dry was found to be more efficient than early burning though somewhat more expensive (14).

Uganda. Termites have been found attacking young healthy growing trees of indigenous species such as *Terminalia brownii* and *Zizyphus mauritiana*. Digging out the termitaria and destroying the queens is the best protection (10).

United States (2). It is concluded that the most efficient method of roadbank fixation is to round off the top of the slopes, thus reducing mechanical action, and to apply a weed mulch in open country, or brush and litter mulches in heavily forested areas, thus providing an adequate seedbed and seed supply (13–4). Released Yellow Poplar will resist *Nectria* canker and throw off existing cankers, whereas White Oak and Black Walnut do not react to release in this way. Investigations of *Mimosa* wilt show that it is caused by soil-borne species of *Fusarium* and that leguminous trees native to the Appalachian region are not susceptible to attack (20). White grubs can be barred from nursery seedbeds by mechanical means and treatment with carbon disulphide will control infestations (21).

United States (4). Studies over the entire range of Lodgepole Pine indicate that, under normal conditions, wind is the factor causing the greatest loss of merchantable volume, particularly on poorly drained sites, and that bark beetles and procupines are mortality factors of next importance (5). Debris left from the original stand on burned-over areas is useful in checking erosion, protecting regeneration, and adding organic matter to the soil. Studies using a portable rainmaker showed that soil losses were greatest on abandoned fields and least on alluvial valley soils on gentle slopes growing Bunchgrass (17–8). Grass is found to be a satisfactory cover in respect to infiltration and erosion on old burns at high altitudes (18).

Wisconsin. A number of White Pines have been noted as surviving severe epidemics of the blister rust and are considered to be resistant (32). Damping-off in Wisconsin nurseries is caused by two fungi, *Pythium*, which is common during cool, damp weather, and *Rhizoctonia*, which prefers warm weather. Exact temperature ranges have been determined for these organisms. A known effective control is soil treatment with 2 per cent. sulphuric acid, although this may be harmful to plants or soil. This disease is particularly harmful to natural reproduction of Red and White Pine on heavy limestone soils, whereas Austrian Pine is little affected (32–5, 58).

ECONOMICS, MANAGEMENT, AND POLICY

British Columbia. Factors contributing to improvement in aerial photography were the use of a powerful, high-wing monoplane that could be flown at relatively high altitude, was smooth and steady in flight and afforded good visibility, an experienced crew whose efficiency was increased by the use of oxygen at high altitudes, the use of radio communications for co-ordination with land parties, and the use of better photographic material such as faster film with 'safety' acetate base, denser filters for haze penetration, and distortion-free printing paper (E15).

Northern Rhodesia. A survey of Barotseland has been completed and a report is in preparation. In the meantime Native Forest Laws have been passed and are in force in all but one district, and a Native Authority Forest Service has been established in two districts (15).

Nyasaland. Based on recent changes in the status of various classes of land, and on the need for the Native Authorities gradually to take over the responsibility of forest protection and management and to share in the forest revenue, a draft revision of forest legislation was made during the year (3).

United States (1). General volume, stand, and yield tables have been prepared for the mixed upland Oak type, and stand and volume tables for Loblolly Pine (7).

United States (4). Yield and volume tables have been prepared for cut-over stands of Lodgepole Pine (5). A test application of the theory of sampling to log scaling shows that a 2 per cent. sample would give a reliable estimate on large sales where the annual cut may be as much as 16 million bd. ft. (5–6).

LIST OF ADDITIONAL ABBREVIATIONS

(Based on the *World List of Scientific Periodicals*)

Appl. For. Note Nth. Rocky Mt. For. & Range Exp. Sta.	Applied Forestry Note. Northern Rocky Mt. Forest and Range Experiment Station. Missoula, Montana.
Arch. Mikrobiol.	Archiv für Mikrobiologie. Berlin.
Bull. Arnold Arbor.	Bulletin of Popular Information. Arnold Arboretum. Cambridge, Mass.
Bull. Cornell agric. Exp. Sta.	Bulletin. Cornell University Agricultural Experiment Station. Ithaca, N.Y.

LIST OF ADDITIONAL ABBREVIATIONS

Bull. Coun. sci. industr. Res. Aust.	Bulletin. Council for Scientific and Industrial Research. Melbourne.
Bull. Harv. For.	Bulletin. Harvard Forest, Petersham, Mass.
Bull. Mass. For. Ass.	Bulletin of the Massachusetts Forestry Association. Boston.
Bull. Mus. Hist. nat., Paris	Bulletin de Muséum d'Histoire Naturelle. Paris.
Bull. N.Z. Dep. sci. industr. Res.	Bulletin of the New Zealand Department of Scientific and Industrial Research. Wellington.
Bull. Ore. agric. Engng. Exp. Sta.	Bulletin. Oregon State College Agricultural Engineering Experiment Station. Corvallis.
Bull. Sch. Agric. For., Taihoku	Bulletin. School of Agriculture and Forestry, Taihoku Imperial University. Taihoku, Japan.
Bull. Vt. agric. Exp. Sta.	Bulletin of the Vermont Agricultural Experiment Station. Burlington.
Bull. Yale Univ. Sch. For.	Bulletin. Yale University School of Forestry. New Haven, Conn.
Burma For. Bull.	Burma Forest Bulletin. Rangoon.
Circ. Okla. agric. Exp. Sta.	Circular. Oklahoma Agricultural Experiment Station. Stillwater.
Curr. Sci.	Current Science. Bangalore.
Elect. Rev., Lond.	Electrical Review. London.
For. Res. Note Pacif. Nthwest. For. & Range Exp. Sta.	Forest Research Note. Pacific Northwest Forest and Range Experiment Station. Portland, Oregon.
Iowa St. Coll. J. Sci.	Iowa State College Journal of Science. Ames.
J. Amer. pharm. Ass.	Journal of the American Pharmaceutical Association. Columbus.
J. chem. Soc.	Journal of the Chemical Society. London.
J. Dep. Agric. W. Aust.	Journal of the Department of Agriculture of Western Australia. Perth.
J. Jap. Bot.	Journal of Japanese Botany. Tokyo.
Leafl. For. Comm., Lond.	Leaflet of the Forestry Commission. London.
Leafl. N.S.W. For. Comm. Div. Wood Tech.	Leaflet. New South Wales Forestry Commission, Division of Wood Technology. Sydney.
Mar. News	Marine News. New York.
Mem. Cornell agric. Exp. Sta.	Memoir. Cornell University Agricultural Experiment Station. Ithaca, N.Y.
Nat. Build., Lond.	National Builder. London.
Nat. canad.	Naturaliste canadien. Quebec.
News Lett. Qd. For. Serv.	News Letter. Queensland Forest Service. Brisbane.
Nuovo G. bot. ital.	Nuovo Giornale Botanico Italiano. Firenze.
Pamphl. N.S.W. For. Comm. Div. Wood Tech.	Pamphlet. New South Wales Forestry Commission, Division of Wood Technology. Sydney.
Prof. Pap. Boyce Thompson Inst.	Professional Paper. Boyce Thompson Institute for Plant Research. Yonkers, N.Y.
Punjab For. Rec.	Punjab Forest Records. Lahore.
Res. Bull. Coll. exp. For. Hokkaido Univ.	Research Bulletin of the College Experimental Forests, Hokkaido Imperial University, Sapporo, Japan.
Res. Rep. Sthwest. For. & Range Exp. Sta.	Research Report. Southwestern Forest and Range Experiment Station. Tucson, Ariz.
Tech. Commun. Imp. Bur. Soil Sci.	Technical Communication. Imperial Bureau of Soil Science. Harpenden, England.
Tech. Note Cent. St. For. Exp. Sta.	Technical Note. Central States Forest Experiment Station. Columbus, Ohio.
Tech. Note Ntheast. For. Exp. Sta.	Technical Note. Northeastern Forest Experiment Station. New Haven, Conn.
Trans. Kans. Acad. Sci.	Transactions of the Kansas Academy of Science. Topeka.

Libraries, other than that of the Imperial Forestry Institute, from which literature was obtained for purposes of recording and abstracting in the present number of *Forestry Abstracts*.

Designation:	*Library of*:
H.S.B.	The Imperial Bureau of Soil Science, Harpenden, England.
K.	The Royal Botanic Gardens, Kew, Surrey.
L.S.	The Science Library, London.
N.H.M.	Natural History Museum, South Kensington, London.
O.B.D.	The Department of Botany, Oxford.
O.R.E.	The School of Rural Economy, Oxford.
O.R.S.	The Radcliffe Science Library, Oxford.
P.R.	The Forest Products Research Laboratory, Princes Risborough.

Publications of the I.A.B. referred to in this number:

Pl. Breeding Abs.	Plant Breeding Abstracts, Cambridge.
R.A.E.	Review of Applied Entomology. London.
R.A.M.	Review of Applied Mycology. Kew.

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